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Submitted to:

Upper Ottawa Street Landfill Site Study
20 Jackson Street West
Suite 412
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URBAN MUNICIPAL
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GOVERNMENT DOCUMENTS

Submitted by:

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Sampling Date: July 15, 1983

Report Date: September 22, 1983

Reference No.: 830320

MONITORING OF LEACHATE & REDHILL CREEK

UPPER OTTAWA STREET LANDFILL SITE

REPORT NO. 1

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1.0 INTRODUCTION

In the summer of 1981, Mann Testing Laboratories Ltd. contracted with the Upper Ottawa Street Landfill Committee to act as a chemical analysis laboratory. In that capacity the company has progressed through several phases of investigation including:

i) Analysis of leachate and bore hole samples

ii) Analysis of core samples

iii) Analysis of air samples on and near the Landfill

iv) Analysis of pre and post flared Landfill gases

This report is the first report of a monitoring program established by the Committee to ensure that pollutants do not begin to leave the site (Figure 1) by surface water migration. A target list of compounds for quantitation has been established (Appendix A) and will serve as a basis for this objective.

The quantitation list was developed by the committee in conjunction with several consultants. It is based on the chemical characterization of the Landfill to date by Mann Testing Laboratories and other organizations. Also toxicity of these chemicals were considered and non-toxic chemicals deleted from the list.

Although the Landfill has been extensively studied, it is conceivable and likely that more chemicals will be characterized as investigations continue. As a result the samples secured for target analysis were exhaustively studied with the objective of adding to the chemical knowledge of the Landfill.

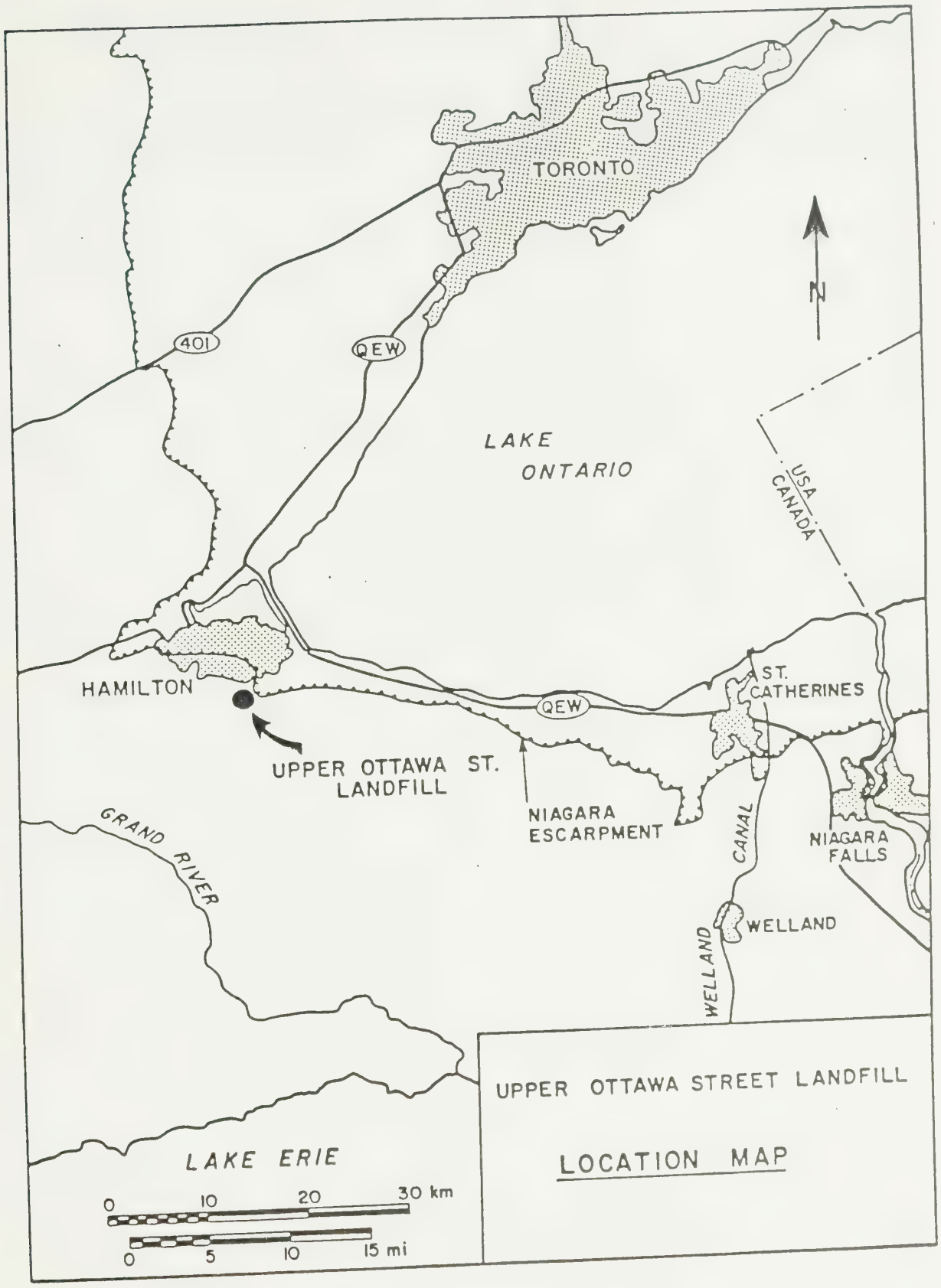


FIGURE 1 - MAP OF LANDFILL LOCATIONS

2.0 SAMPLING PROTOCOL

For the purpose of monitoring migration of pollutants from the Landfill site three sampling locations have been established:

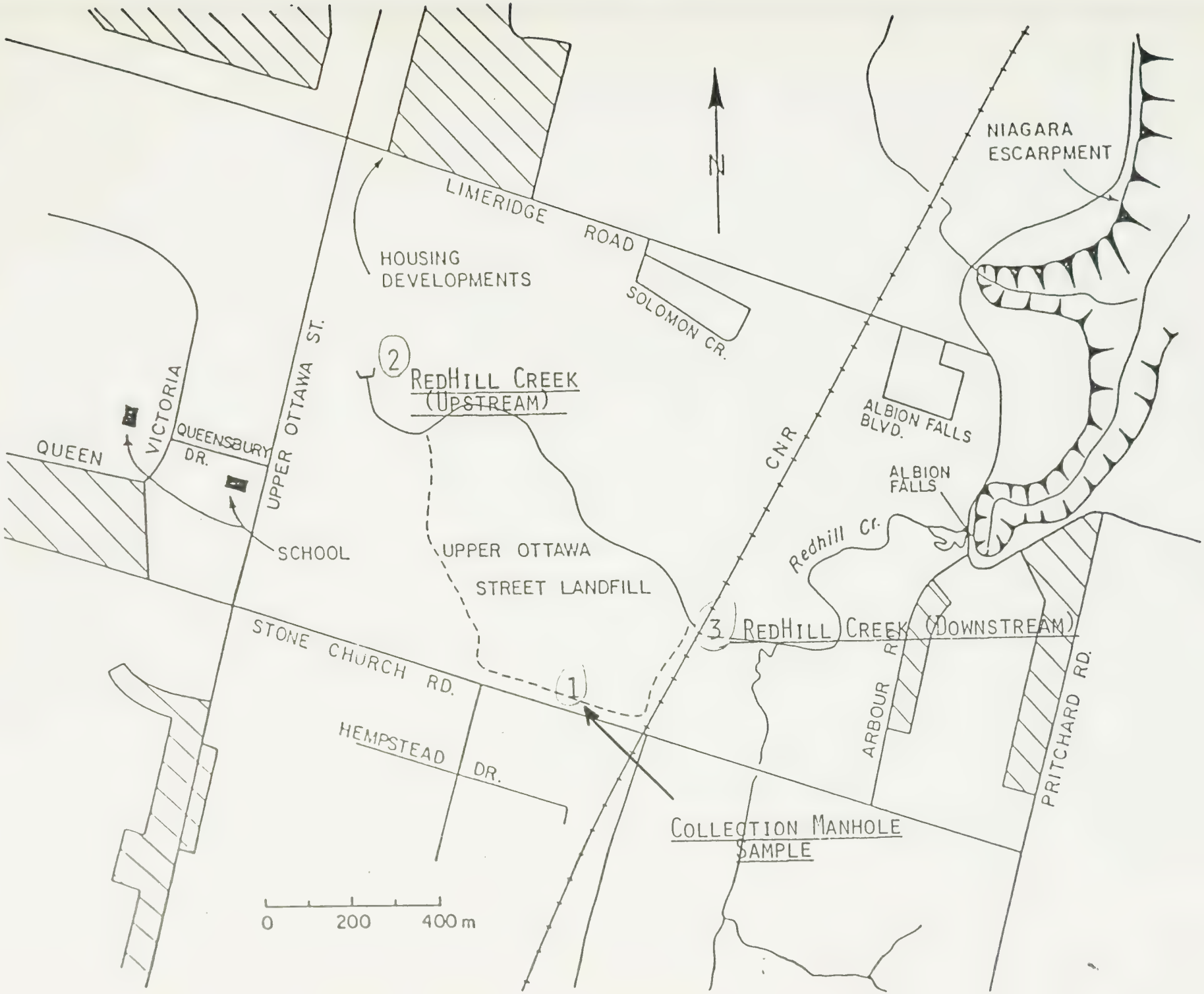
1. Collection Manhole
2. Redhill Creek (Upstream)
3. Redhill Creek (Downstream)

Figure 2 is a map of the Landfill site and shows the approximate locations of these sampling sites.

The collection manhole is an interesting location since it serves as a reservoir for leachate from the west side of the Landfill. The sample typically is highly concentrated with aromatic volatile compounds and oily waste.

Redhill creek flows directly around the landfill from the north side, along the eastern face, to the southern tip, where it leaves the site. Prior analysis of the creek has shown very little chemical contamination that can be attributed directly to the Landfill, although leachate can be seen entering the creek.

In order to ensure that the Redhill Creek (Upstream) sample was not contaminated by landfill groundwater, a sampling location far "Upstream" was attempted. Since the creek is covered for a long distance this objective was not attained. Upstream samples were then secured as the water exited the concrete culvert prior to falling into the stream bed. In this manner it was felt that a truly "Upstream" sample was secured, and that it was not influenced by the Landfill.


N
LIMERIDGE ROAD
HOUSING DEVELOPMENTS
SOLOMON CR.
NIAGARA ESCARPMENT
2 REDHILL CREEK (UPSTREAM)
VICTORIA
QUEENSBURY DR.
QUEEN
UPPER OTTAWA ST.
SCHOOL
UPPER OTTAWA STREET LANDFILL
C.N.R.
ALBION FALLS BLVD.
ALBION FALLS
Redhill Cr.
3 REDHILL CREEK (DOWNSTREAM)
STONE CHURCH RD.
HEMPSTEAD DR.
1
ARBOUR RD.
PRITCHARD RD.
COLLECTION MANHOLE SAMPLE
0 200 400 m

These three sampling locations appear to give the best samples for a long term monitoring program. The first set of samples were secured by J. Martin on July 15, 1983 and are reported herein. All samples were taken in pre-washed glass containers and stored at 4°C until analysed.

3.0 RESULTS OF TARGET ANALYSIS

3.1 General

The three samples were analysed by GC/Mass Spectrometry based upon EPA Priority Pollutant [1] methods. The procedure is outlined in Section 4.0.

The Manhole collection sample was the most interesting from a chemistry point of view. Volatile organics were found in abundance from a high of 18.7 ppm for p-dioxane to <0.5 ppt level for trichloroethylene. This vast range in concentration necessitated triplicate analysis of the volatiles utilizing sample volumes of 30, 10 and 1.0 ml.

The extractables from the Manhole Collection sample were also highly concentrated in heavier organics, consisting chiefly of a series of C_7-C_{30} aliphatic hydrocarbons at a concentration range of 2-50 ppb. Also present was a variety of long chain carboxylic esters and various phthalate esters. In order to isolate and identify the many base neutral compounds on the quantitation (TARGET) list an extensive sample clean-up and fractionation process was necessary.

GC/MS chromatograms and related data are included as Appendix B.

3.2 Volatile Organics - Results

Table No. I is a presentation of volatile organics targeted for quantitation purposes. The list is more extensive for volatiles than that requested, however it was felt that the added information would be valuable to the committee and therefore this quantitation data was included.

The collection Manhole sample showed high concentrations (ppm) of p-dioxane, tetrahydrofuran and carbon disulfide. Methyl ethyl ketone, a common constituent of paints was found at 525.2 ppb while all other constituents were less than 100 ppb. The highest level of any halogen was chloroform at 22.5 ppb followed by 1,4-dichlorobenzene at 8.8 ppb. Normal levels of chloroform in drinking water range from 5 to 10 ppb and therefore the levels found in the landfill are not alarming. Dichlorobenzene is widely used as a wick deodorant in washrooms and therefore its presence is also not alarming.

The volatiles found in Redhill Creek in the majority are below 1.0 ppb and close to the method detection limit. As a result, it is difficult to compare results with any degree of certainty or accuracy. However, there does appear to be a contribution of small amounts of dichloromethane, ethyl ether, chloroform and tetrahydrofuran. Tetrachloroethylene appears to be in higher concentrations upstream than downstream and this is unexplained. However, these concentrations are, again, extremely low.

TABLE I

CONCENTRATIONS OF VOLATILE - ORGANICS
IN UPPER OTTAWA ST. LANDFILL SITE SAMPLES

Compound	Concentration in ppb Red Hill Creek Upstream Sample	Red Hill Creek Downstream Sample	Manhole Sample	MDL*
Deuterated Chlorobenzene	-	-	-	-
1,1-Dichloroethylene	-	-	-	0.5
Carbon Disulfide	<0.5	<0.5	<0.5	0.5
Acetone	1.1	<0.5	1002.2	0.5
Tetrahydrofuran	<1.0	1.4	1212.6	1.0
1,1-Dichloroethane	-	<0.5	3.7	0.5
1,1,1-Trichloroethane	-	<0.5	-	0.5
Ethyl Methyl Ketone	-	-	525.2	0.5
Benzene	<0.5	<0.5	3.6	0.5
Trichloroethylene	<0.5	<0.5	<0.5	0.5
Chloroform	<0.5	1.7	22.5	0.5
Tetrachloroethylene	1.3	<0.5	-	0.5
Toluene	<0.2	<0.2	30.4	0.2
Ethyl Benzene	-	<0.2	9.2	0.2
p-Xylene	-	<0.2	32.4	0.2
m-Xylene	-	-	51.3	0.2
o-Xylene	-	-	58.6	0.2
Chlorobenzene	-	-	-	0.5
Styrene	<0.5	0.9	37.1	0.5
1,2,4-Trimethyl Benzene	-	-	15.8	0.5
N-Methyl-N-Nitrosomethanamine	-	-	-	5.0
1,3-Dichlorobenzene	-	-	1.1	0.5
Bromoform	-	-	-	1.0
1,4-Dichlorobenzene	<0.5	<0.5	8.8	0.5
1,2-Dichlorobenzene	-	-	1.9	0.5
1,2,3,4-Tetramethylbenzene	-	-	5.2	1.0
Aniline	-	-	15.0	1.0
p-Dioxane	-	-	18663.0	-
Dichloromethane	<0.5	15.2	221.5	0.5
Ethyl Ether	-	14.7	86.1	-

MDL - Method Detection Limit (ppb)
Where a " - " appears the compound was not detected.

TABLE II

TENTATIVE IDENTIFICATION OF VOLATILE ORGANICS
IN UPPER OTTAWA ST. LANDFILL SITE - COLLECTION MANHOLE

(Peaks detected but not in the quantification list for purgeables)

GC PEAK NO.	SCAN NO.	BASE PEAK	TENTATIVE IDENTIFICATION
1	254	45	Diethyl ether
2	283	45	Dimethoxymethane $C_3H_8O_2$
3	291	47	Ethyl Mercaptan
4	320	43	2-Heptananone
5	340	59	1,1'-[Methylenebis(oxy)]bis-ethane
6	415	43	2-Pentanone
7	433	57	Methyl nonane
8	442	41	Dimethyl Butanone
9	448	57	C_{11} Hydrocarbon
10	509	43	5-Hexen-2-ol
11	557	91	2-Propenylidene-cyclobutene
12	593	43	2,2,5-Trimethyl-3,4-Hexanedione
13	650	60	2-Methyl-thietane
14	683	91	1-Ethenyl-3-Methylene-Cyclopentene
15	737	57	2-Methyl-4-Octanone
16	746	93	1,5,5,6-Tetramethyl-1, 3-Cyclohexadiene
17	784	43	3-Methyl-2-Heptanone
18	819	105	1-Ethyl-4-Methyl Benzene
19	834	60	1,3-Oxathiolane
20	869	105	1-Ethyl-2-Methyl Benzene
21	878,946	119	1-Methyl-4-(1-MethylEthyl)-Benzene
22	895	105	(1-MethylEthyl)-Benzene
23	919	105	1-Methyl-2-Propyl Benzene
24	966	105	1-Ethyl-2-Methyl Benzene
25	981	119	1-Ethyl-2,3-Dimethyl Benzene
26	990	119	4-Ethyl-1,2-Dimethyl Benzene
27	999	119	2-Ethyl-1,3-Dimethyl Benzene
28	1010	117	2,3-Dihydro-1H-Indene
29	1016	83	3,3,5-Trimethyl-Cyclohexanone
30	1065,1136	119	1-Ethyl-2,3-Dimethyl-Benzene
31	1078	119	2-Ethyl-1,3-Dimethyl-Benzene
32	1111	69	5-Methyl-2-(1-MethylEthyl)-Cyclohexanone
33	1152	117	1-Methyl-2-(2-Propenyl)-Benzene
34	1173	41	2,7,7-Trimethyl-3-oxatricyclo [4.1.1.02,4]octane
35	1385	128	Naphthalene
36	1445	134	Benzo[B]Thiophene
37	1499	141	1-Methyl-Naphthalene
39	1540	141	2-Methyl-Napthalene

Very little in the way of volatile organics are picked up by Redhill Creek at this time. It is interesting to note that the high levels of p-dioxane, MEK, THF, and acetone in the landfill are not migrating to the creek.

Volatile organics not quantitated but identified in the analyses in the Collection Manhole sample are listed in Table II. They consist mainly of substituted aromatics, ketones, hydrocarbons and light PAH's.

3.3 Extractable Pollutants - Results

The results of the analysis have been summarized in Table III. Table IV contains the extraction system percent recoveries and minimum detection limits of the extractable pollutants targeted for analysis. In general the B/N fractions from the Redhill Creek sites were quite clean, with Bis(2-ethylhexyl) phthalate at approximately 20 ppb being the only compound of interest detected. It appears that this compound is contributed from sources upstream of the Landfill. The collection manhole sample contained the highest percentage of pollutants, these being primarily polynuclear aromatic hydrocarbons (PAHs) occurring in the 3-20 ppb range.

The highest concentrations of acidic pollutants, phenols and cresol, were detected at the collection manhole site. Similar but slightly lower levels of phenol were found in the Redhill downstream sample at the 70.2 ppb level. Very low levels of phenol (below MDL) were detected in the Redhill Creek upstream sample. Lower levels of cresol and 2,4-dimethyl phenol are finding their way into the stream from the Landfill.

TABLE III

UPPER OTTAWA ST. LANDFILL SITE
CONCENTRATION OF EXTRACTABLE POLLUTANTS IN
UPPER OTTAWA ST. LANDFILL SITE SAMPLES
(CONC = ppb)

BN Compounds	Red Hill Creek Upstream	Red Hill Creek Downstream	Collection Manhole	MDL
4-Methyl Pyridine	-	-	-	1.4
Napthalene	-	-	11.8	0.4
Benzothophene	-	-	-	0.4
Benzothazole	-	-	-	0.4
Isoquinoline	-	-	-	1.7
Napthalene,1-Methyl	-	-	<0.8	0.8
Napthalene,1,2-Dimethyl	-	-	<2.0	2.0
Dimethyl-Phthalate	-	-	-	1.0
Acenapthylene	-	-	-	0.5
Dibenzo Furan	-	-	-	0.8
Napthalene,1,6,7-Trimethyl	-	-	-	0.8
Diethyl Phthalate	-	-	-	5.0
Anthracene	-	-	19.8	0.3
2-Methyl Anthracene	-	-	-	1.2
Fluoranthene	-	-	10.6	0.6
Pyrene	-	-	10.5	0.5
Benz(A) Anthracene	-	-	3.1	0.5
Bis(2-Ethyl,Hexyl) Phthalate	24.3	21.2	13.1	0.9
Benzo(B) Fluoranthene	-	-	-	0.6
Benzo(C) Pyrene	-	-	-	0.4
ACIDIC COMPOUNDS				
Phenol	<1.6	70.2	98.1	1.6
Cresol	-	11.1	25.7	2.2
2,4-Dimethyl Phenol	-	5.6	10.5	2.5

TABLE IV

UPPER OTTAWA ST. LANDFILL SITE

ACIDIC COMPOUNDS	DERIV MW	MW	RRT	% REC	MDL
Phenol	94	94	0.253	21.0	1.6
Cresol	108	122	0.271	72.0	2.2
2,4-Dimethyl Phenol	122	136	0.415	58.8	2.5
Deuterated Phenol(I.S.)	99	-	0.252	31.8	2.0
Deut. 2-Nitro Phenol(I.S.)	143	157	0.596	60.4	2.0
Deut. 4-Nitro Phenol(I.S.)	143	157	0.642	83.7	2.5
D10 Anthracene (I.S.)	188	-	1.010	97.0	0.5
D10 Phenanthrene (I.S.)	188	-	1.000	100.0	0.5

* I.S. = Internal Standard

TABLE IV Cont'd.

B/N COMPOUNDS COMPOUND	M/E MN	CHAR ION	RRT	% REC	MDL
4-Methyl Pyridine	93	93,92,66	.165	42.3	1.4
Napthalene	128	128,127	.459	74.3	0.4
Benzothophene	134	134,90	.464	52.0	0.4
Benzothiazole	135	135,90	.489	33.7	0.4
Isoquinoline	129	129,102	.525	9.7	1.7
Napthalene,1-Methyl	142	142,141	.588	27.4	0.8
Napthalene,1,2-Dimethyl	156	156,141	.695	64.1	2.0
Dimethyl-Phthalate	-	163	.711	20.0	1.0
Acenaphthylene	152	152,151	.717	74.6	0.5
Dibenzofuran	168	168,139	.782	43.7	0.8
Napthalene - 1,6,7-Trimethyl	170	170,155	.831	83.4	0.8
Diethyl Phthalate	-	149,177	.841	83.5	5.0
Anthracene	178	178	1.013	70.0	0.3
2-Methyl Anthracene	192	192,189	1.107	55.0	1.2
Fluoranthene	202	202,100	1.216	75.9	0.6
Pyrene	202	202,100	1.252	69.5	0.5
Benz(a)anthracene	228	228,226	1.500	71.1	0.5
Bis(2-Ethyl,Hexyl) Phthalate	-	149,167	1.584	78.3	0.9
D10 Phenathrene(I.S.)	188	188	1.00	98.1	0.5
Benzo(b)fluoranthene	-	252,136	1.761	56.8	0.6
Benzo(a)pyrene	-	252,136	1.822	60.6	0.4
D10 Anthracene (I.S.)	188	-	1.010	86.3	0.5
D8 Napthalene (I.S.)	136	-	0.440	74.3	0.4

* I.S. = Internal Standard

4.0 ANALYTICAL METHODS

4.1 Volatiles

4.1.1 Sampling Preparation - Collection and Handling

Water samples for purgeable organics were collected in 250 ml capacity amber glass bottles equipped with Tuf-Bond discs and screw caps with a syringe access hole in the centre. The bottles had been previously cleaned and heated at 200°C for at least 4 hours, purged with nitrogen and sealed with PTFE coated silicone and open top caps prior to transportation to the sampling sites. The water samples were collected by J. Martin of Mann Testing Laboratories Ltd.

The bottles were filled to slight overflow, then sealed so that no air bubble was present in the sample. They were immediately returned to Mann Testing Labs and stored at 4°C until analysed.

4.1.2 Preparation of Standard Solutions

Stock standard solutions were prepared by injecting appropriate amounts of each pollutant into 25-ml of glass distilled methanol (Burdick and Jackson) in reactiflasks fitted with Minnert valves (Chromatographic Specialities Ltd.) which provide complete protection and easy access via a hypodermic needle. The resulting concentrations of 1 mg/ml were further diluted to give methanolic solutions of 400 ug/ml, 40 ug/ml and 4 ug/ml for each component. Gaseous standards were prepared in a similar manner by injecting the gaseous compound from a 10 ml gas tight syringe into a pre-weighed reactiflask filled with ∠5

ml of methanol. The syringe needle was slightly above the methanol meniscus while injecting, hence enabling the gas to dissolve rapidly into the methanol. The flask was re-weighed again to determine the amount in the solution.

Aqueous composite standards were prepared by injecting appropriate aliquots of methanolic standard in 250 ml sample bottles filled with purified water.

The relative retention times (RRT) were compared to that of the internal standard, deuterated chlorobenzene (RRT = 1.00) which eluted close to the middle of the chromatogram. Detection limits were determined by purging aqueous composite standard mixture at various concentrations.

4.1.3 Instrumentation

Analysis of volatile organics in water was conducted using a UNACON 780B automatic concentrator (Envirochem Inc., Kemblesvile, P.A.). This instrument utilized the technique developed by Bellar and Lichtenberg for the isolation and concentration of volatiles for chromatographic analysis. In general, this process involved gas stripping of the sample and adsorption of the organic compounds on a sorbent trap followed by thermal desorption and analysis by gas chromatography or gas chromatography/mass spectrometry.

The sample purging assembly included a sparger vial with a side port which was equipped with an open top screw cap and Tuf-Bond septum. A 30 ml vial was used to obtain detection limits as reported. Sample was transferred to the vial through a transfer line by pressurizing the sample bottle which was

inverted and clamped on the side of the instrument. The transfer line was constructed of 1/16" teflon tubing with two Luer Lock connectors at each end. Two 17-gauge needles were used to puncture the septa of both the bottle and the side port.

Prior to the start of the analysis, the sparger vial was purged with helium for 5 minutes by rotating the valve to "Trap-Out" mode. In this position, any contaminants that were present in the sparger vial were purged out of the system without entering the trap. An appropriate aliquot of the water was then transferred to the sparger and purged for 15 minutes at the "Trap In" mode. The trap was heat desorbed and the organics backflushed into the second trap. When this transfer process was completed, the second trap was again heated, releasing all adsorbed organics into the capillary GC/MS system for identification and quantification.

The water sample was analyzed 3 times using 1 ml, 10 ml and 30 ml volumes to eliminate saturation of the GC/MS system.

The MDL (Method Detection Limit) listed in the volatile section is the limit that the compound can be identified and quantified in the sample matrix using the purge & trap GC/MS method.

4.2 Procedure for Extractables

All glassware was detergent washed, rinsed successively with distilled water, glass distilled acetone, then oven dried. It was then rinsed with glass distilled CH_2Cl_2 prior to use. 1 litre water samples were spiked with deuterated internal standards at a concentration of 50 ppb prior to their extraction. D_{10} Anthracene was used to monitor the overall efficiency of the extraction, while D_8 Napthalene indicates the loss of the more volatile compounds due to the concentration process. Similarly deuterated phenols were used for the acid fraction. For quantitation purposes, all extracts were spiked at 50 ppb with D_{10} Anthracene immediately prior to GC/MS analysis.

The samples were extracted following the standard EPA procedure, Method #625 for solvent extraction of waste water, ie:

- a 1 litre volume of waste water was spiked with 50 ppb of a deuterated std. mix
- the pH adjusted to pH 11 using 6N NaOH solution
- extracted with 3 x 60 ml of CH_2Cl_2 (Base/Neutral, pesticides)
- the combined organic phase is dried by passing it through a 4" x 1/2" column of solvent washed Na_2SO_4
- the dried extract is collected in a 1 litre KUDERNA-DANISH evaporator. 2 mls of isooctane is added, and the extract concentrated to a 2 ml volume
- the extract is transferred to a 10 ml graduated centrifuge tube spiked with 50 ppb of D_{10} Phenanthrene and concentrated to 1.0 ml using a gentle stream of nitrogen
- the remaining aqueous phase is acidified to pH 2 with 6N HCL and extracted with 3 x 60 ml CH_2CL_2 to remove the acidic and phenatic compounds
- the combined organic extracts dried using a column containing acidified Na_2SO_4 (2%-H_2SO_4), spiked with 50 ppb of D_{10} Anthracene, concentrated to 2 mls using a K/D evaporator

- 2 mls of isooctane and 0.5 ml of 3% Diazomethane/ether solution added and the extract sealed and allowed to stand at room temperature overnight
- after derivatization, the extract is concentrated to 1 ml using nitrogen then spiked with 50 ppb D_{10} Phenanthrene

4.3 Gas Chromatographic/Mass Spectrometry Analysis

One ul aliquot of the 1 ml extracts were analysed for the presence of the selected pollutants using a Finnigan 4500 GC/MS system set to the following conditions:

MASS SPECTROMETER

Electron Multiplier	- 1650 eV
Ionization Energy	- 70 eV
Sensitivity	- 108 amps/volt
Scan Rate	- 2.25 mSec/mass unit
Scan Range	- 1-2000/32 min
Mass Range	- 45-450

GAS CHROMATOGRAPH

GC Column	- DB-1 30 M capillary
GC Temp Program	
Initial	- 50°C (0.1 min)
Final	- 285°C (20 min)
Rate	- 10°C/min
Injection Port Temp	- 250°C
Column Carrier Gas	- Helium

REFERENCES

Longbottom, James E. and Lichtenberg, James J. Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater, EPA-600/4-82-057, July 1982.

APPENDIX A

FINAL QUANTITATED LIST CONT'D

Phenol

Methyl phenol (cresol) (isomers cumulative)

Dimethyl phenol (xylenol) (isomers cumulative)

1 methyl-2-pyrrolidine

~~3-(2-hydroxypropyl-5-methyl)-2-oxazolidinone~~

N-methyl-N-nitroso-methanamine

N,N-diethyl-N'-methyl-N'-nitrosourea

Joe Roderick's - additions to be included

1) 1,4 dioxane
2) 1,2 - dimethylhydrozine
3) 3,5 - dimethyl - 4 - nitrosomorpholine
4) butane nitrile
5) carbon disulphide

For Marine Lab monitor of [illegible] samples.

Copy.

FINAL QUANTITATED LIST

Dichloroethane

Trichloroethane

Trichloroethylene

Tetrachloroethylene

Benzene

Toluene

Xylenes & Ethyl Benzene (cumulative)

C_3 Benzenes (cumulative)

C_4 Benzenes (cumulative)

Tetrahydrofuran

Dimethyl phthalate

Diethyl phthalate

Bis (2-ethyl hexyl) phthalate

Napthalene

Methylated naphthalenes (cumulative)

Anthracene

Methylated anthracenes (cumulative)

Pyrene

Methylated pyrenes (cumulative)

Benzo (a) anthracene

Benzo (b) fluoranthene

Benzo (a) pyrene

Benzo (e) pyrene

Acenaphthalene

Fluoranthene

Benzothiophene

Benzothiazole

Dibenzofuran

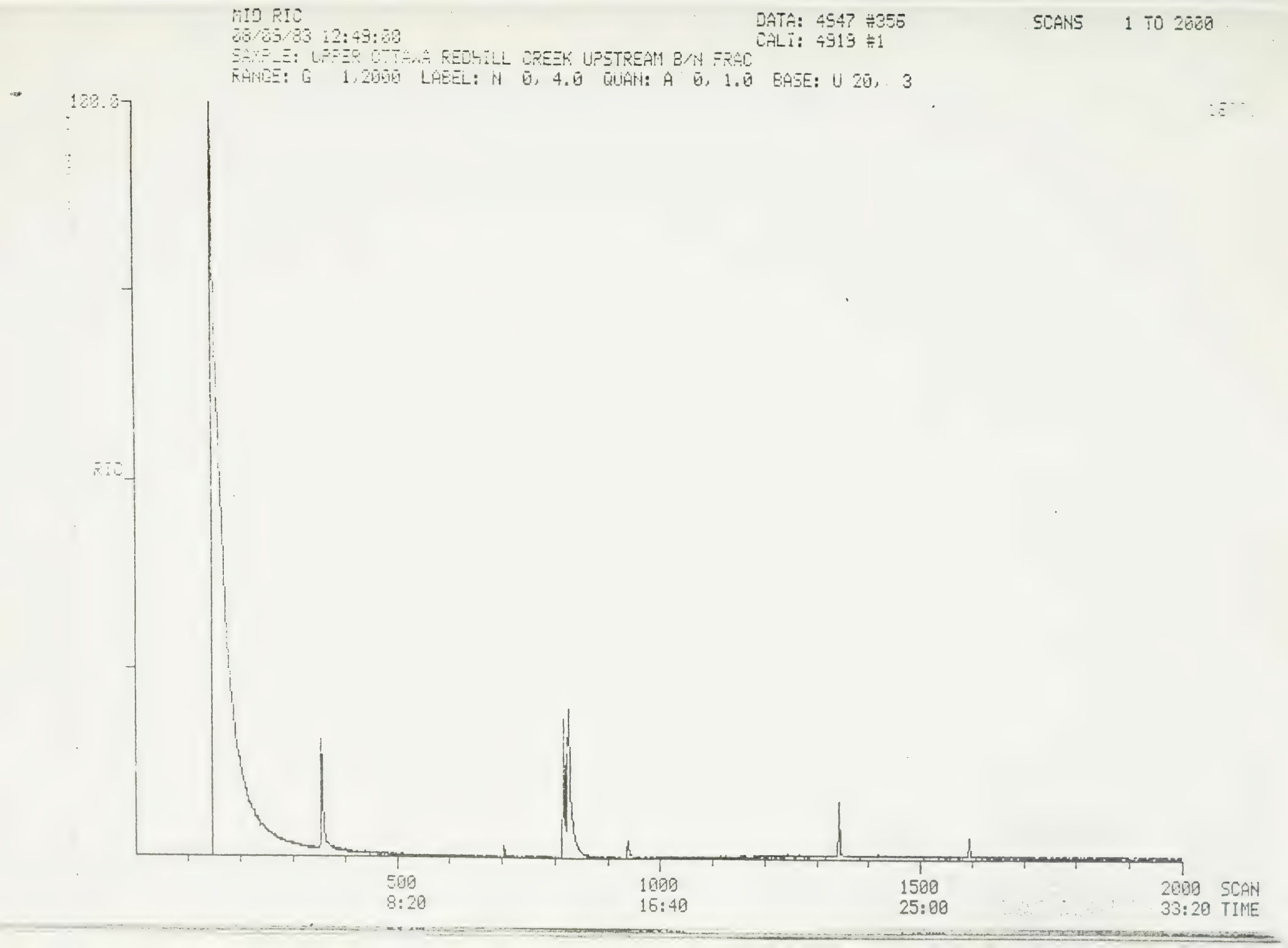
Isoquinoline

Aniline

Nitroso aniline (nitroaniline?)

Methyl pyridine (picoline)

APPENDIX B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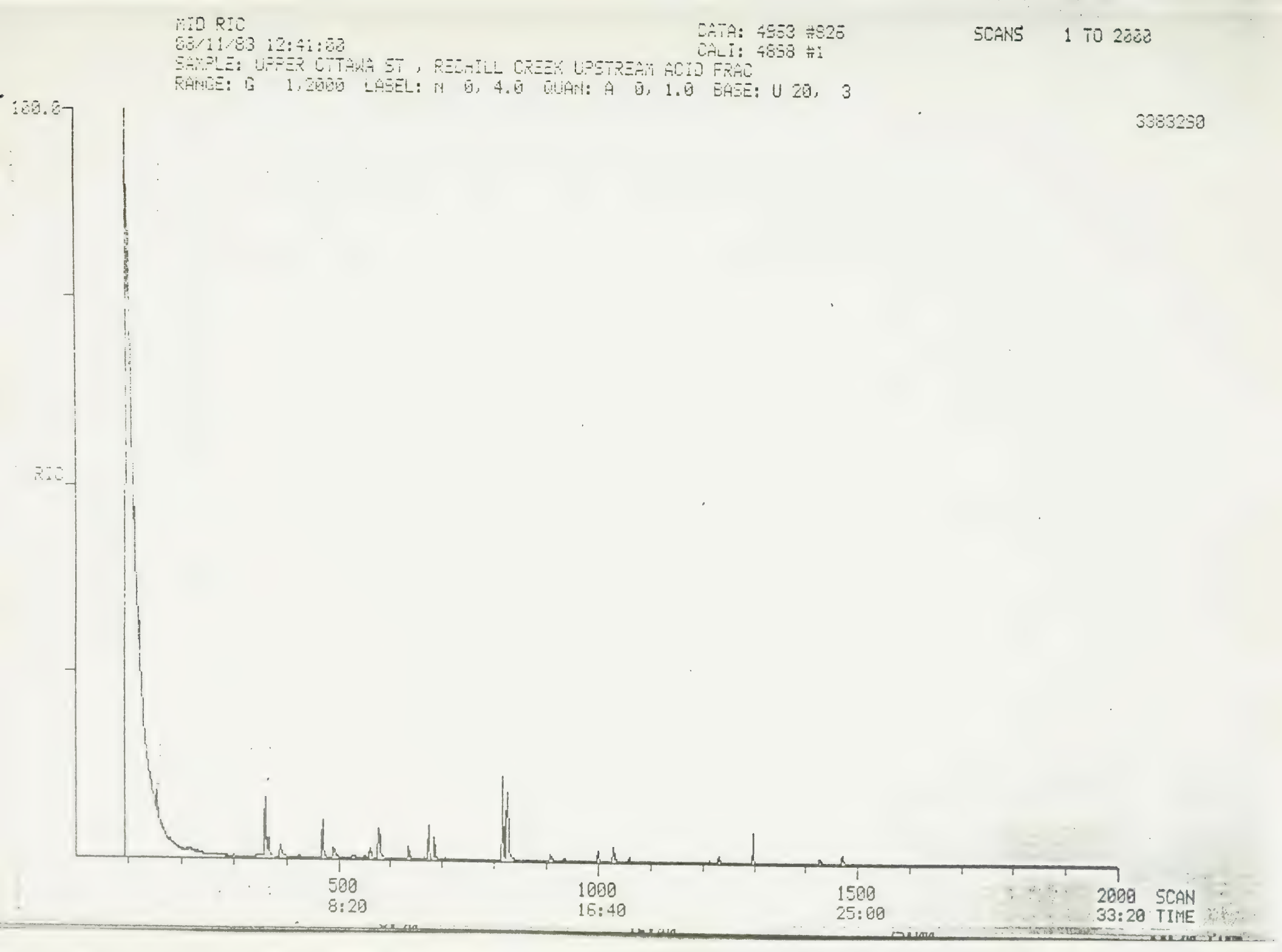
CALI: 4513 #1
SCANS 1 TO 2000
RANGE: G 1,2000 LABEL: N 0, 4.0 QUAN: A 0, 1.0 BASE: U 20, 3
100.0
RIC
500
8:20
1000
16:40
1500
25:00
2000 SCAN
33:20 TIME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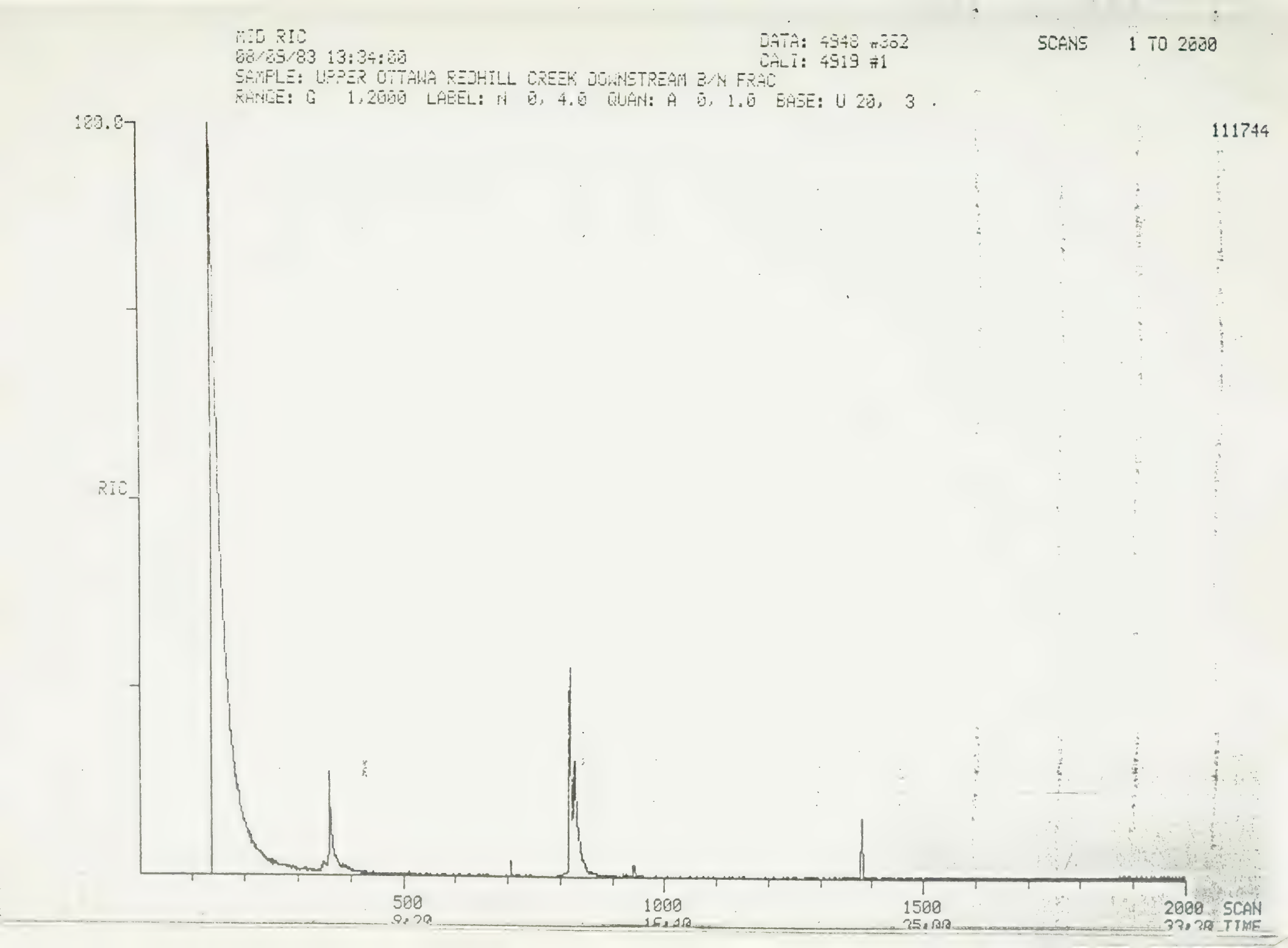
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1000
1500
2000 SCAN
TIME

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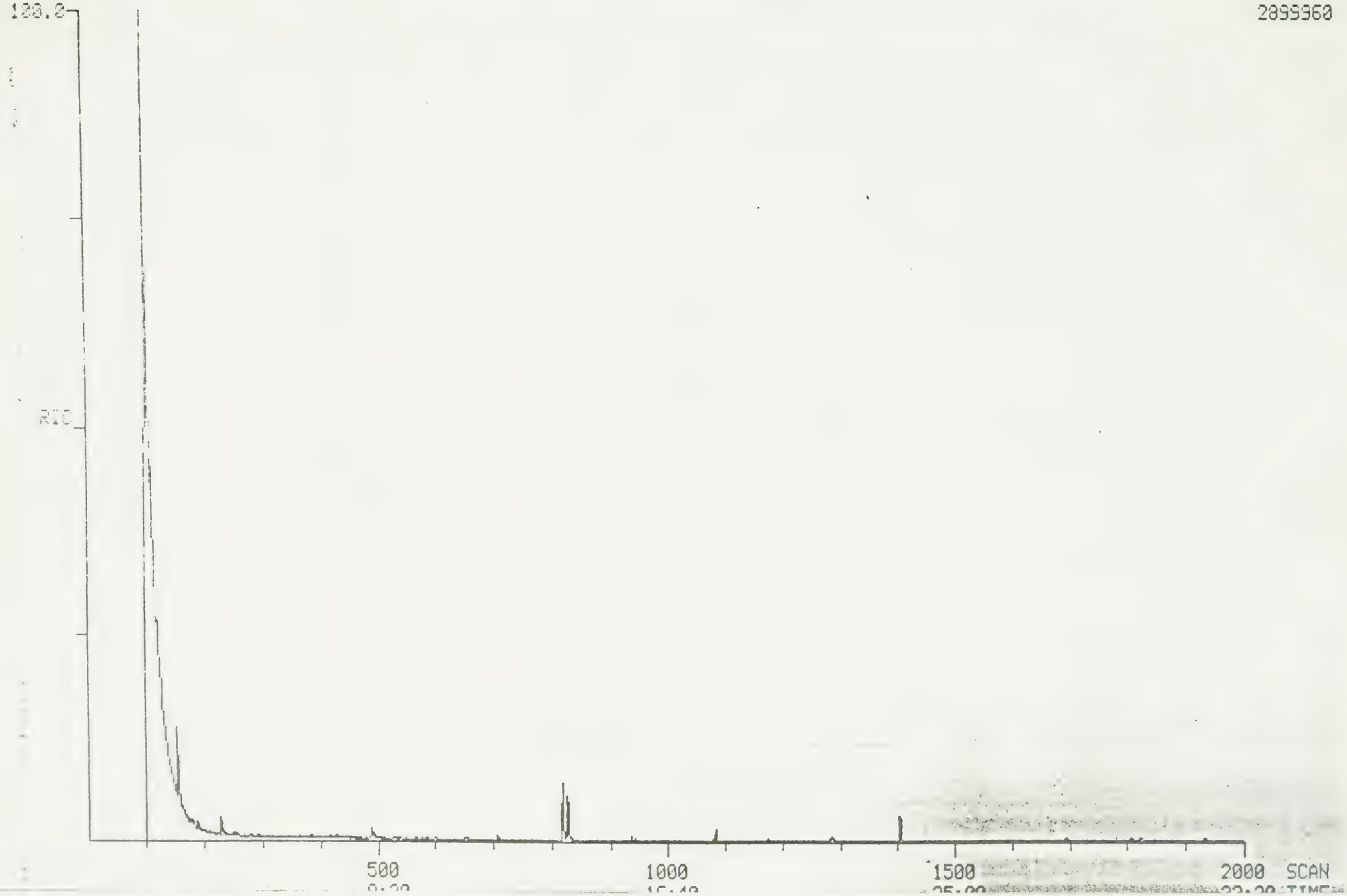

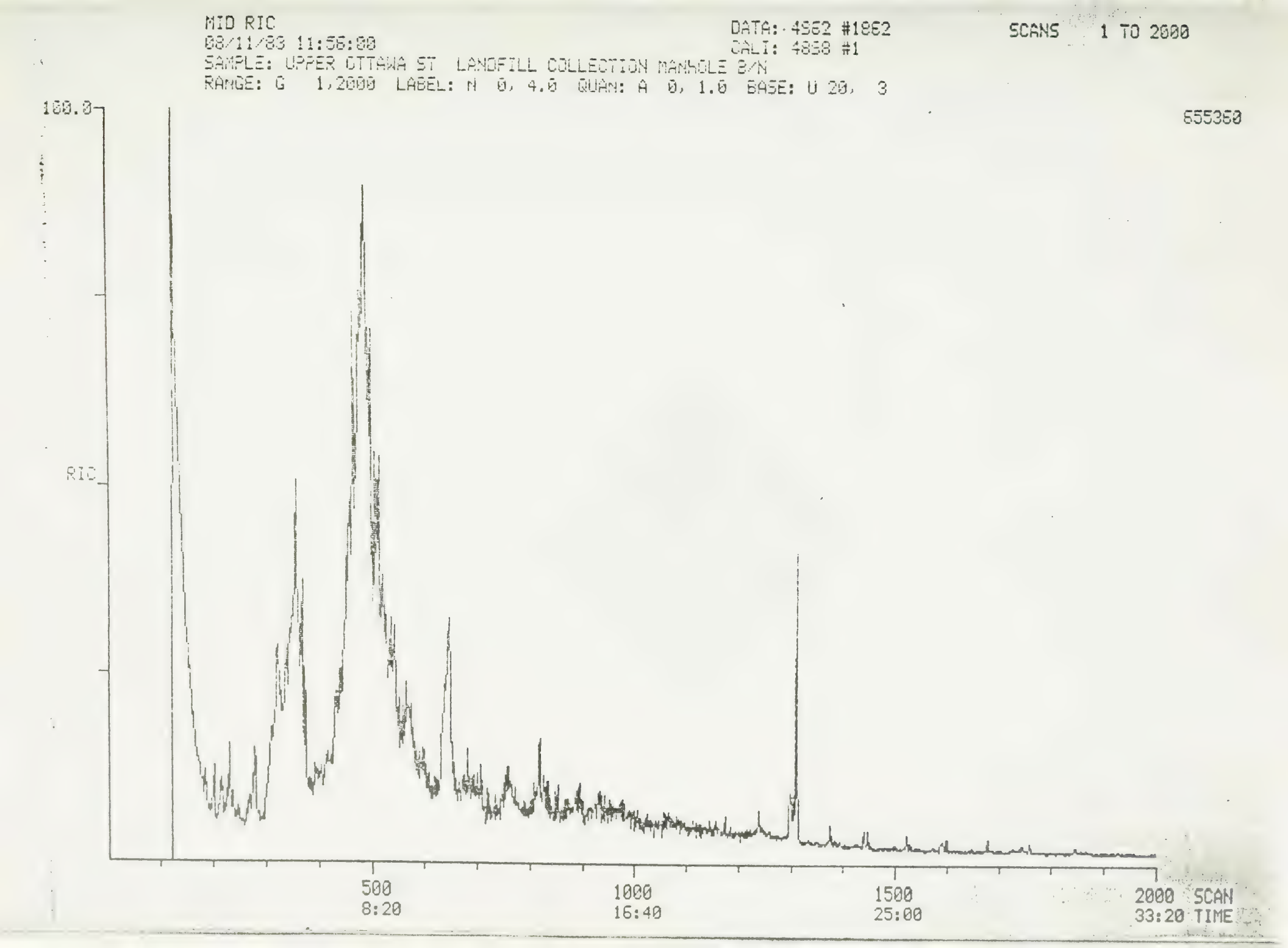
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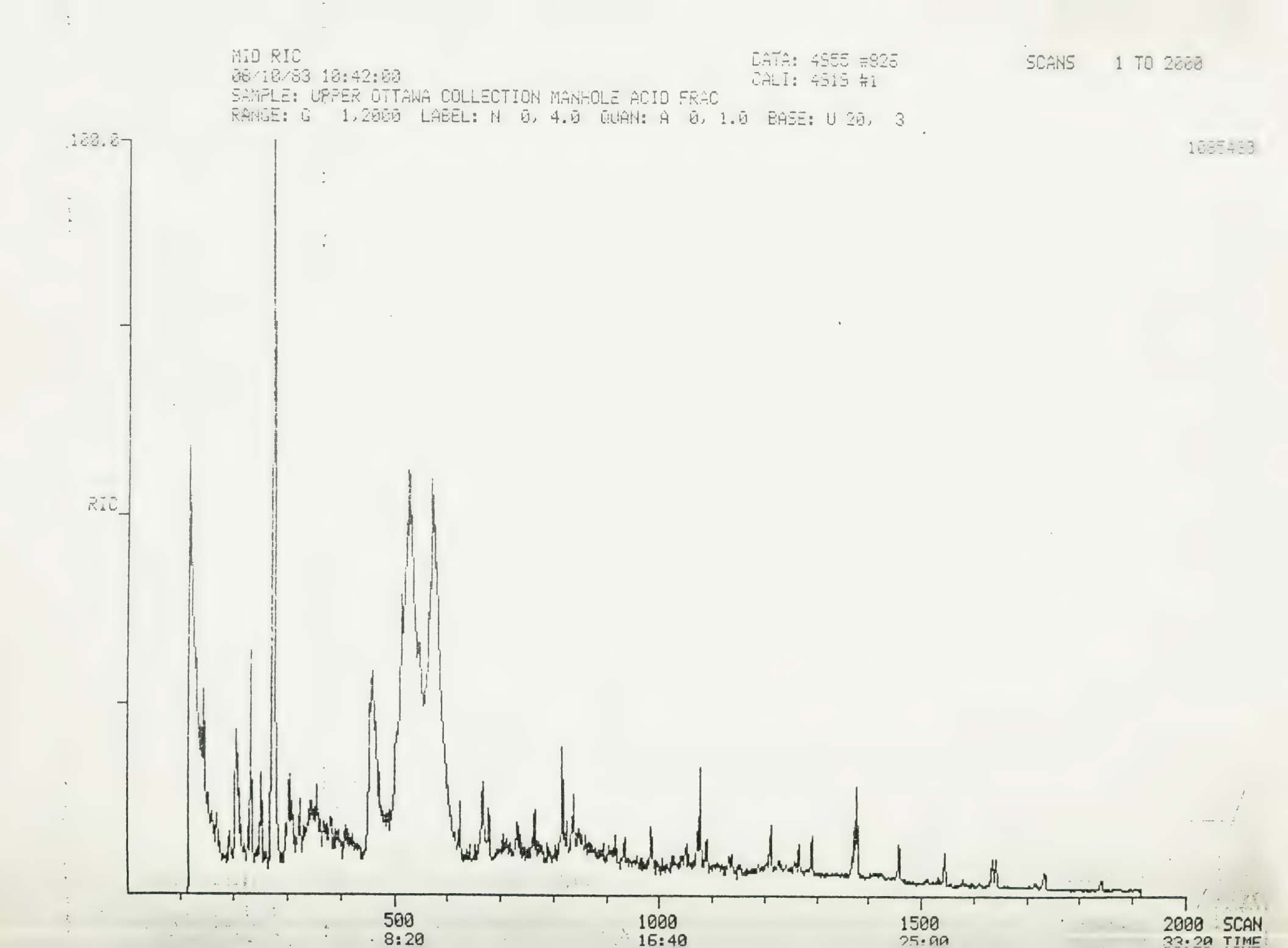
25:00
2000 SCAN
33:20 TIME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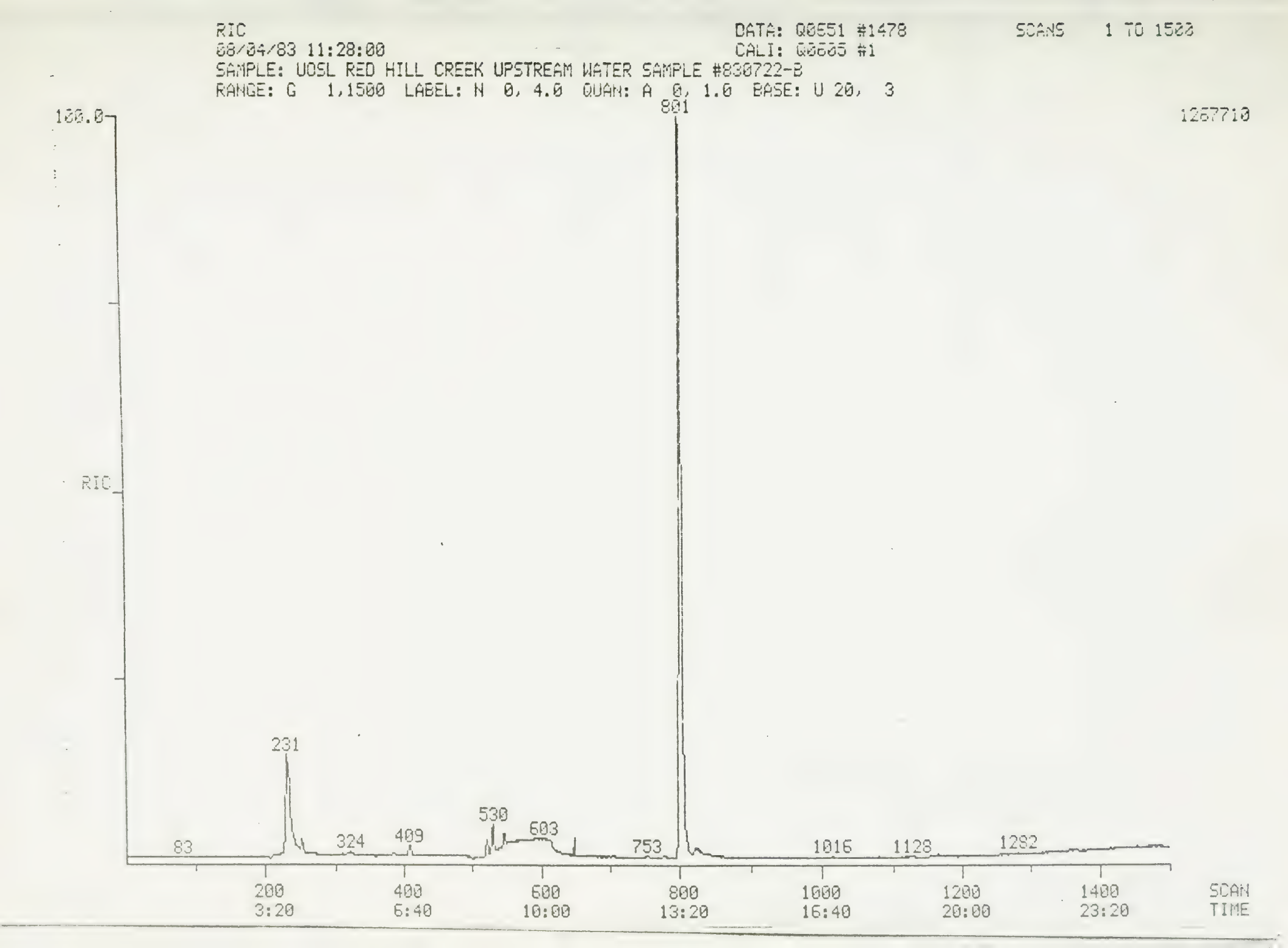
8:20
1000
16:40
1500
25:00
2000 SCAN
33:20 TIME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1128
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200
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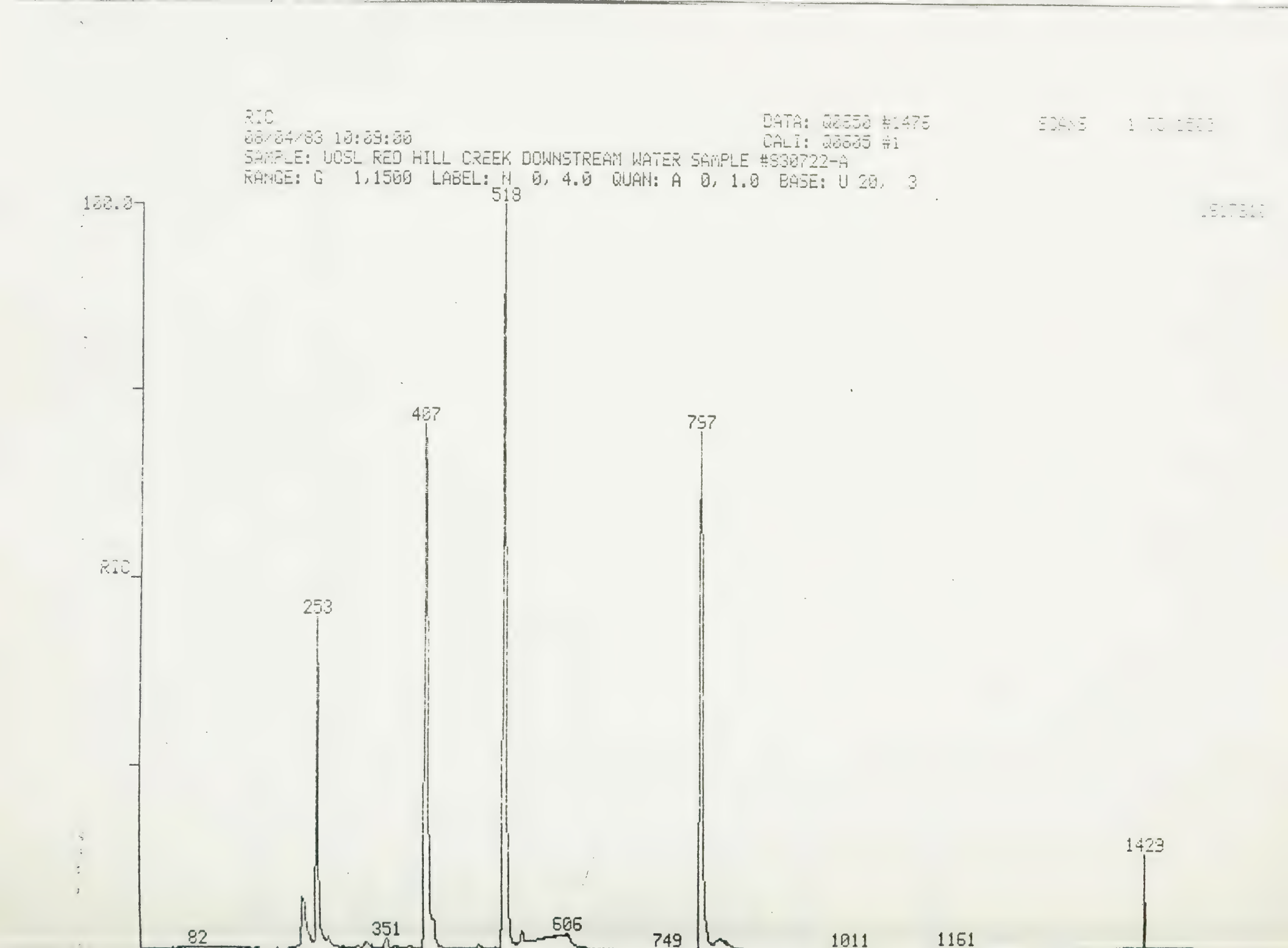
SCAN
TIME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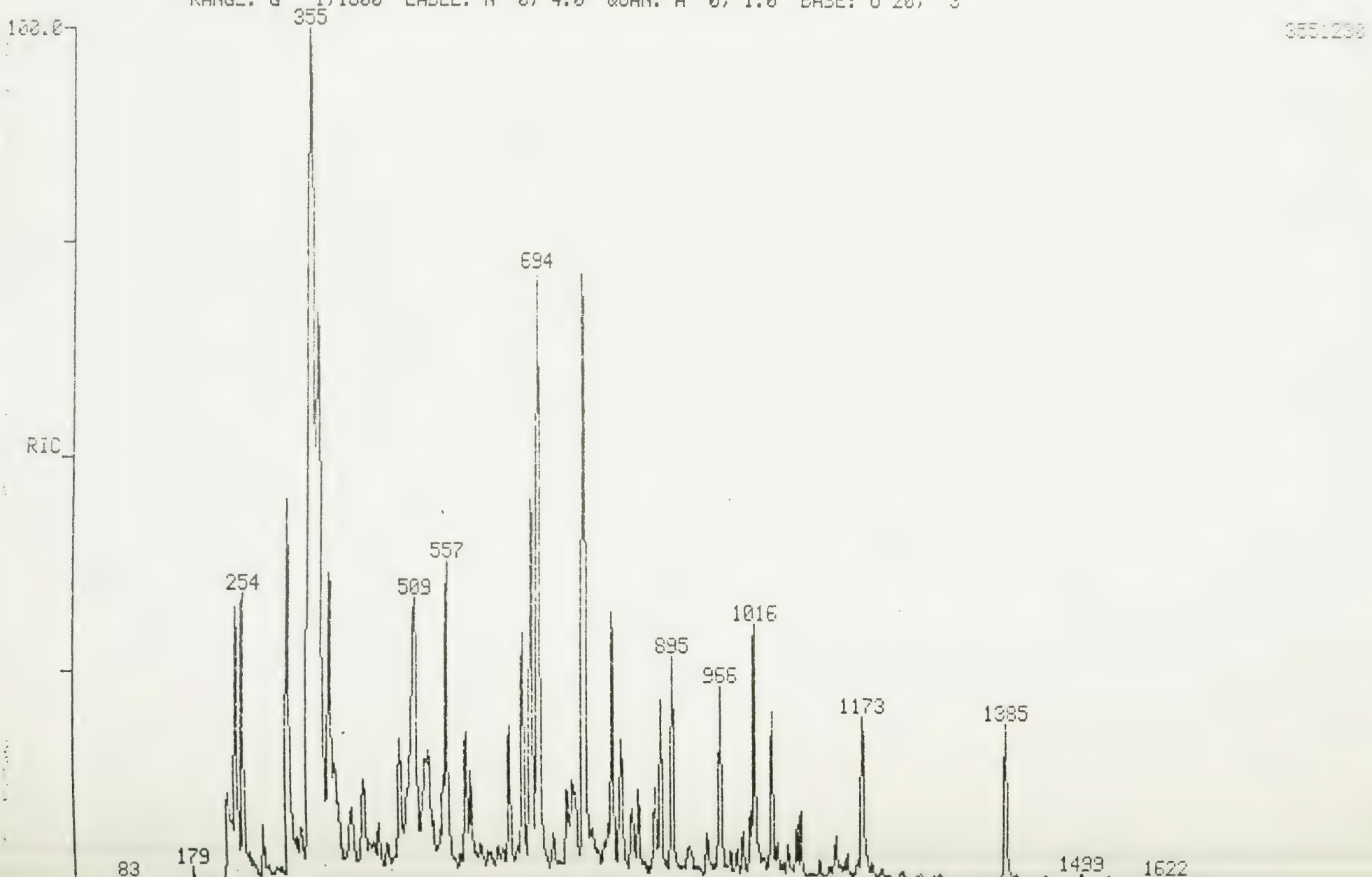
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RANGE: G 1,1800 LABEL: N 0, 4.0 QUAN: A 0, 1.0 BASE: U 20, 3
100.0
RIC
355
694
557
509
254
1016
895
955
1173
1385
179
83
1499
1622

Submitted to:

Upper Ottawa Street Landfill Site Study
20 Jackson Street West
Suite 412
Hamilton, Ontario
L8P 1L2

Submitted by:

Mann Testing Laboratories Ltd.
5550 McAdam Road
Mississauga, Ontario
L4Z 1P1

Sampling Date: March 21, 1984

Report Date: October 26, 1984

Reference No: Lab. No. 841279

MONITORING OF LEACHATE & REDHILL CREEK

UPPER OTTAWA STREET LANDFILL SITE

REPORT NO. 2

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TABLE III - Upper Ottawa Priority Pollutants Pesticide Scan by ECD

1.0 INTRODUCTION

This report is the second of a water monitoring program for the Upper ottawa Street Landfill. The first monitoring report was submitted on September 22, 1983 under Mann Testing reference no. 830320.

Please refer to that report for background information.

2.0 SAMPLING

Three water samples were secured by J. Martin of Mann Testing Laboratories Ltd. Sampling sites and methods were identical to those for the first monitoring program.

It is important to note that the water flow rates were significantly higher during this sampling.

3.0 RESULTS OF TARGET ANALYSIS

3.1 General

The three samples were analysed by GC/MS spectrometry based on EPA Priority Pollutant methods. In addition an extremely sensitive dual column, dual ECD detector gas chromatographic system was used for chlorinated organics. In total twenty of the most common chlorinated hydrocarbons (pesticides and PCB's) were screened in the part per trillion range.

The levels of organic contaminants found during this monitoring program were significantly lower than those determined by the first monitoring program. For immediate comparison purposes the following are listed from the Leachate Collection Manhole:

Compound	1st Monitoring	2nd Monitoring
Tetrahydrofuran	1212	1548
Chloroform	22	2
1,4-Dichlorobenzene	9	6
1,4-Dioxane	18663	949
Phenol	98	TR
Napthalene	11.8	TR

This is not a total list of all contaminants found but does give an idea of the general trend. We believe the lower concentrations of the organic contaminants is directly related to the higher volume of spring run-off water around the landfill.

3.2 Volatile Organics - Results

Table No. I is a presentation of volatile organics targetted for quantitation purposes.

The Collection Manhole sample again showed high concentrations of tetrahydrofuran and 1,4-dioxane. However the numbers of compounds detected and their relative amounts were far lower than the 1st monitoring program.

The Red Hill Creek samples showed the same relative trend. Only chloroform was detected above the minimum detection limit and the amount in the stream did not change appreciably past the landfill.

Although the flows in the Collection Manhole and the stream could not be measured they were extremely high. Spring thaw was in progress and it was difficult taking samples due to the high waters. The dilution effect was obviously a factor and should be considered when interpreting these results.

3.3 Extractable Organics - Results

The results of analysis by GC/MS have been summarized in Table II. Further analysis by a dual column capillary gas chromatograph with dual electron capture detectors is given in Table III.

The chlorinated hydrocarbons analysed in Table III duplicate the GC/MS screen but at a much lower detection limit. In general this improvement is from 10 to 100 times more sensitive. It is also very specific to halogenated compounds.

Because of its sensitivity and selectivity this screen compliments the GC/MS analysis. No chlorinated organics were detected which fortifies results from previous work.

The majority of extractable organics detected were at the trace level. Bis(2-ethylhexyl) phthalate was determined between 24.8 and 360.0 ppb in all samples. It was the highest level contaminant. The levels of extractable contaminents were affected similarly by the high volume of water flowing.

4.0 METHODOLOGY

Methods of analysis are equivalent to those given in Monitoring Report No. 1. All quality control procedures, recoveries and mass chromatograms are available on request.

TABLE I

CONCENTRATIONS OF VOLATILE ORGANICS IN WASTEWATER SAMPLES (ppb)

No.	Compound	Red Hill Creek Upstream	Red Hill Creek Downstream	Leachate Collection Manhole	MDL
PURGEABLES					
1	1,1-Dichloroethylene	-	-	-	1
2	Acetone	-	-	-	1
3	Tetrahydrofuran	-	-	1548.61	1
4	1,1-Dichloroethane	-	-	12.56	1
5	1,1,1-Trichloroethane	-	-	-	1
6	Ethyl Methyl Ketone	-	-	-	-
7	Benzene	-	-	-	1
8	Trichloroethylene	-	-	-	1
9	Chloroform	1.35	1.01	2.15	1
10	Tetrachloroethylene	-	-	-	1
11	Toluene	-	-	BMDL	1
12	Ethyl Benzene	-	-	-	1
13	p-Xylene	-	-	-	1
14	m-Xylene	-	-	-	1
15	o-Xylene	-	-	-	1
16	Chlorobenzene	-	-	-	1
17	Styrene	-	-	-	1
18	1,2,4-Trimethyl Benzene	-	-	-	-
19	N-Methyl-N-Nitrosomethanamine	-	-	-	-
20	1,3-Dichlorobenzene	-	-	-	1
21	Bromoform	-	-	-	1
22	1,4-Dichlorobenzene	-	-	6.07	1
23	1,2-Dichlorobenzene	-	-	-	1
24	1,2,3,4-Tetramethylbenzene	-	-	-	-
25	Aniline	-	-	-	-
26	4-Methyl Pyridine	-	-	-	-
27	1,4-Dioxane	-	-	949.27	100
28	1-Methyl-2-Pyrolidine	-	-	-	-

BMDL = Below Method Detection Limit

TABLE II

UPPER OTTAWA PRIORITY POLLUTANTS

GC/MS ACID EXTRACTABLES

ACIDIC COMPOUNDS	Upstream	Downstream	Collection Manhole	MDL (ppb)
Phenol	-	-	BMDL	1.5
2-Chlorophenol	-	-	-	2.0
2,4-Dimethyl phenol	BMDL	BMDL	7.4	2.0
p-Chloro-m-cresol	-	-	-	2.0
2,4-Dichlorophenol	-	-	-	2.5
2,4,6-Trichlorophenol	-	-	-	3.0
2-Nitrophenol	-	-	-	2.0
2,4-Dinitrophenol	-	-	-	5.0
4,6-Dinitro-o-cresol	-	-	-	4.0
Pentachlorophenol	BMDL	BMDL	BMDL	3.0
4-Nitrophenol	-	-	-	2.1
2,4-D	-	-	-	2.5
Silvex	-	-	-	2.4
o-Cresol	-	-	-	2.1
m-Cresol	-	-	-	2.3
p-Cresol	-	-	-	3.0
2,4,5-Trichlorophenol	-	-	-	2.0
2,4,5-T	-	-	-	2.5

BMDL = Below Method Dectection Limit

TABLE II

UPPER OTTAWA PRIORITY POLLUTANTS

GC/MS BASE/NEUTRAL EXTRACTABLES

BASE/NEUTRAL COMPOUNDS	Upstream	Downstream	Collection Manhole	MDL (ppb)
Bis(2-Chloro Ethyl)Ether	BMDL	BMDL	-	1.0
1,4-Dichlorobenzene	BMDL	BMDL	7.7	0.4
1,3-Dichlorobenzene	BMDL	BMDL	-	0.4
bis(2-Chloroisopropyl)ether	-	-	-	1.0
1,2-Dichlorobenzene	-	BMDL	-	0.4
Nitrobenzene	-	-	-	0.5
N-Nitrosodi-n-propylamine	-	-	-	0.5
Hexachloroethane	-	-	-	1.0
Isophorone	-	-	-	0.4
bis(2-Chloroethoxy)methane	-	-	-	0.4
Naphthalene	BMDL	3.2	BMDL	0.4
1,2,4-Trichlorobenzene	-	-	-	1.3
Hexachlorobutadiene	-	-	-	0.5
Hexachlorocyclopentadiene	-	-	-	3.0
2-Chloronaphthalene	-	-	-	0.8
2,6-Dinitrotoluene	-	-	-	2.0
Dimethyl phthalate	-	-	-	1.0
Acenaphthylene	-	-	BMDL	0.5
Acenaphthene	-	-	1.1	0.4
2,4-Dinitrotoluene	-	-	-	1.5
Diethyl phthalate	-	-	-	5.0
9H Fluorene	2.0	BMDL	-	0.4
4-Chlorophenyl phenyl ether	-	-	-	1.0

BMDL = Below Method Detection Limit

TABLE II

UPPER OTTAWA PRIORITY POLLUTANTS

GC/MS BASE/NEUTRAL EXTRACTABLES

BASE/NEUTRAL COMPOUNDS	Upstream	Downstream	Collection Manhole	MDL (ppb)
N-Nitroso-Diphenylamine	-	-	BMDL	0.4
1,2-Diphenyl Hydrazine	-	-	-	0.6
4-Bromophenyl phenyl ether	-	-	-	0.5
Hexachlorobenzene	-	-	-	1.2
Phenanthrene	0.6	0.8	-	0.3
Anthracene	-	BMDL	-	0.3
Di-n-butyl phthalate	-	-	BMDL	0.4
Fluoranthene	BMDL	BMDL	0.5	0.4
Benzidene	-	-	-	10.0
Pyrene	BMDL	BMDL	BMDL	0.5
Butylbenzyl phthalate	-	-	-	0.8
Chrysene	-	-	BMDL	0.4
Benzo(a)anthracene	-	-	BMDL	0.5
3,3-Dichlorobenzidene	-	-	-	2.0
Bis(2-ethylhexyl)phthalate	24.8	92.0	360.0	0.9
Di-n-octyl phthalate	-	-	-	1.5
Benzo(a)pyrene	-	-	BMDL	0.3
Benzo(k)fluoranthene	-	-	BMDL	0.4
Benzo(b)fluoranthene	-	-	-	0.6
Dibenzo (a,h) anthracene	-	-	BMDL	4.0
Benzo(g,h,i)perylene	-	-	BMDL	2.0
Indeno(1,2,3-CD)pyrene	-	-	-	1.3
Coronene	-	-	-	2.5
Perylene	-	-	-	2.5

BMDL = Below Method Detection Limit

TABLE II

UPPER OTTAWA PRIORITY POLLUTANTS

ADDITIONAL COMPOUNDS

ADDITIONAL COMPOUNDS	Upstream	Downstream	Manhole	(ppb)
4-Methyl Pyridine	-	-	-	0.8
Benzothiophene	-	-	-	0.4
Benzothiazole	-	-	-	0.8
Isoquinoline	-	1.4	BMDL	0.5
1-Methyl Naphthalene	2.2	5.5	-	0.5
1,2-Dimethyl Naphthalene	15.6	10.0	-	0.6
Dibenzofuran	-	-	-	0.3
2,3,5-Trimethyl Naphthalene	-	-	-	0.5
2-Methyl Anthracene	BMDL	BMDL	-	0.8

BMDL = Below Method Detection Limit

UPPER OTTAWA PRIORITY POLLUTANTS

PESTICIDE COMPOUNDS	Upstream	Downstream	Collection Manhole	MDL (ppt)
Alpha BHC	-	-	-	100
Gamma BHC	-	-	-	100
Beta BHC	-	-	-	100
Delta BHC	-	-	-	100
Fluchloralin	-	-	-	100
Heptachlor	-	-	-	100
Aldrin	-	-	-	100
Heptachlor Epoxide	-	-	-	100
Oxychlordane	-	-	-	100
Alpha Endosulfan	-	-	-	100
4,4'-DDE	-	-	-	100
Dieldrin	-	-	-	100
Endrin	-	-	-	100
Beta Endosulfan	-	-	-	100
4,4'-DDD	-	-	-	100
Endrin Aldehyde	-	-	-	100
Endosulfan Sulfate	-	-	-	100
4,4'-DDT	-	-	-	100
Mirex	-	-	-	100
Total PCB	-	-	-	500

Submitted to:

Upper Ottawa Street Landfill Site Study
20 Jackson Street West
Suite 412
Hamilton, Ontario
L8P 1L2

Submitted by:

Mann Testing Laboratories Ltd.
5550 McAdam Road
Mississauga, Ontario
L4Z 1P1

Sampling Date: December 11, 1984

Report Date: March 11, 1985

Reference No: Lab. No. 842226

MONITORING OF LEACHATE & REDHILL CREEK

UPPER OTTAWA STREET LANDFILL SITE

REPORT NO. 4

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- Upper Ottawa Priority Pollutants GC/MS Base/Neutral Extractables Base/Neutral Compounds

- Upper Ottawa Priority Pollutants GC/MS Additional Compounds

TABLE III - Upper Ottawa Priority Pollutants Pesticide Scan by ECD

1.0 INTRODUCTION

This report is the fourth of a water monitoring program for the Upper Ottawa Street Landfill. Previous reports were submitted on September 22, October 18, 1984 and January 17 1985 under Mann Testing reference no.s 830320, 841279 and 842007 respectively.

Please refer to those reports for background information.

2.0 SAMPLING

Three water samples were secured by J. Martin of Mann Testing Laboratories Ltd. Sampling sites and methods were identical to those for the previous monitoring programs.

3.0 RESULTS OF TARGET ANALYSIS

3.1 General

The three samples were analysed by GC/MS spectrometry based on EPA Priority Pollutant analysis methodology. In addition an extremely sensitive dual column, dual ECD detector gas chromatographic system was used for chlorinated organics. In total twenty of the most common chlorinated hydrocarbons (pesticides and PCB°s) were screened in the part per trillion range.

The levels and types of organic contaminants found during this monitoring program were comparable to the previous monitoring programs. For immediate comparison purposes the following are listed from the Leachate Collection Manhole:

	Amount (ppb)			
Compound	1st	2nd	3rd	4th
Tetrahydrofuran	1212	1548	2456	3700
Chloroform	22	2	-	-
1,4-Dichlorobenzene	9	6	1.0	3.3
1,4-Dioxane	18663	949	6745	16700
Phenol	98	TR	TR	TR
Napthalene	11.8	TR	TR	TR

This is not a total list of all contaminants found but does give an idea of the general trend.

3.2 Volatile Organics - Results

Table No. I is a presentation of volatile organics targetted for quantitation purposes.

The Collection Manhole sample showed higher concentrations of tetrahydrofuran and 1,4-dioxane than seen in the previous monitoring program.

The Red Hill Creek samples showed the same relative trend. None of the target compounds were present above the minimum detection limit as was seen in the previous studies.

3.3 Extractable Organics - Results

The results of analysis by GC/MS have been summarized in Table II. Further analysis by a dual column capillary gas chromatograph with dual electron capture detectors is given in Table III.

UPPER OTTAWA LANDFILL VOLATILE ORGANICS

No.	Compound	Red Hill Creek Upstream	Red Hill Creek Downstream	Leachate Collection Manhole	MDL
PURGEABLES					
1	Dichlorodifluromethane	-	-	-	1
2	Trichlorofluoromethane	-	-	-	1
3	Vinyl chloride	-	-	-	3
4	Chloromethane	-	-	-	1
5	Chloroethane	-	-	-	3
6	Bromomethane	-	-	-	1
7	1,1 Dichloroethylene	-	-	-	1
8	Acrolein	-	-	-	10
9	t-1,2 Dichloroethylene	-	-	-	1
10	1,1 Dichloroethane	-	-	2.40	1
11	Carbon tetrachloride	-	-	-	1
12	1,1,1 Trichloroethane	-	-	-	1
13	Dichloromethane	-	Tr	11.7 ppm	5
14	Benzene	-	-	Tr	1
15	Trichloroethylene	Tr	Tr	-	1
16	Acrylonitrile	-	-	-	10
17	Chloroform	Tr	Tr	-	1
18	Tetrachloroethylene	-	-	-	1
19	1,2 Dichloropropane	-	-	-	1
20	Toluene	-	-	3.5	1
21	1,2 Dichloroethane	-	-	-	1
22	2 Chloroethyl Vinyl ether	-	-	-	ND
23	Ethyl Benzene	-	-	-	1
24	1,3 Dichloropropene (Z)	-	-	-	1
25	p-Xylene			32.3	1*
26	m-Xylene				
27	Bromodichloromethane	-	-	-	1
28	O-Xylene	-	-	17	1
29	1,3 Dichloropropene (E)	-	-	-	1
30	Chlorobenzene	-	-	-	1
31	1,1,2-Trichloroethane	-	-	-	1
32	Dibromochloromethane	-	-	-	1
33	1,3 Dichlorobenzene	-	-	-	1
34	Hexachloroethane	-	-	-	1
35	Bromoform	-	-	-	1
36	1,4 Dichlorobenzene	-	-	3.3	1
37	1,1,2,2-Tetrachloroethane	-	-	-	1
38	1,2 Dichlorobenzene	-	-	-	1
39	a-chlorotoluene	-	-	-	1
40	Bis-(chloromethyl)ether	-	-	-	ND
41	Bis-(2-chloroethoxy)methane	-	-	-	ND
42	Acetone	-	-	-	2
43	Diethyl ether	-	-	-	2
44	Carbon disulphide	-	-	-	1
45	Ethyl Methyl Ketone	-	-	-	1
46	Tetrahydrofuran	-	2.7	3.7 ppm	1
47	1,4-Dioxane	-	-	16.7 ppm	80
48	N-Methyl-N-Nitroso-methanamine	-	-	-	ND
49	Styrene	-	-	-	1
50	1,2,3,4-Tetramethyl benzene	-	-	-	1
51	Aniline	-	-	-	ND
52	4-Methyl Pyridine	-	-	-	ND
53	1-Methyl-2-Pyrrolidine	-	-	-	ND

ND = Not determined

UPPER OTTAWA LANDFILL SAMPLES

DECEMBER 11, 1984

Additional Compounds Detected

- substituted benzoixc acid derivatives
  - dimethyl
  - chloro, dichloro-
- methylated benzenes - C_1, C_4
- Benzothiazolone
- Isoquinolone
- Methoxy-1,2-Benzothiazole

UPPER OTTAWA PRIORITY POLLUTANTS

December 11, 1984

ACIDIC COMPOUNDS	Upstream	Downstream	Collection Manhole	MDL (ppb)
Phenol	-	1.5	Tr	1.5
2-Chlorophenol	-	-	-	2.0
2,4-Dimethyl phenol	-	-	Tr	2.0
p-Chloro-m-cresol	-	-	-	2.0
2,4-Dichlorophenol	-	-	-	2.5
2,4,6-Trichlorophenol	-	-	-	3.0
2-Nitrophenol	-	-	-	2.0
2,4-Dinitrophenol	-	-	-	5.0
4,6-Dinitro-o-cresol	-	-	-	4.0
Pentachlorophenol	-	-	-	3.0
4-Nitrophenol	-	-	-	2.1
2,4-D	-	-	-	2.5
Silvex	-	-	-	2.4
o-Cresol	-	-	-	2.1
m-Cresol	-	-	-	2.3
p-Cresol	-	-	-	3.0
2,4,5-Trichlorophenol	-	-	-	2.0
2,4,5-T	-	-	-	2.5

Tr = Trace amount is detected below MDL

UPPER OTTAWA PRIORITY POLLUTANTS

December 11, 1984

BASE/NEUTRAL COMPOUNDS	Upstream	Downstream	Collection Manhole	MDL (ppb)
Bis(2-Chloro Ethyl)Ether	-	-	-	1.0
1,4-Dichlorobenzene	-	-	-	0.4
1,3-Dichlorobenzene	-	-	-	0.4
bis(2-Chloroisopropyl)ether	-	-	-	1.0
1,2-Dichlorobenzene	-	-	-	0.4
Nitrobenzene	-	-	-	0.5
N-Nitrosodi-n-propylamine	-	-	-	0.5
Hexachloroethane	-	-	-	1.0
Isophorone	-	-	-	0.4
bis(2-Chloroethoxy)methane	-	-	-	0.4
Naphthalene	-	-	BMDL	0.4
1,2,4-Trichlorobenzene	-	-	-	1.3
Hexachlorobutaciene	-	-	-	0.5
Hexachlorocyclopentadiene	-	-	-	3.0
2-Chloronaphthalene	-	-	-	0.8
2,6-Dinitrotoluene	-	-	-	2.0
Dimethyl phthalate	-	-	-	1.0
Acenaphthylene	-	-	-	0.5
Acenaphthene	-	-	-	0.4
2,4-Dinitrotoluene	-	-	-	1.5
Diethyl phthalate	BMDL	-	-	2.0
9H Fluorene	-	-	-	0.4
4-Chlorophenyl phenyl ether	-	-	-	1.0

BASE/NEUTRAL COMPOUNDS	Upstream	Downstream	Collection Manhole	MDL (ppb)
N-Nitroso-Diphenylamine	-	-	-	0.4
1,2-Diphenyl Hydrazine	-	-	-	0.6
4-Bromophenyl phenyl ether	-	-	-	0.5
Hexachlorobenzene	-	-	-	1.2
Phenanthrene	BMDL	BMDL	3.8	0.3
Anthracene	-	-	-	0.3
Di-n-butyl phthalate	1.2	1.2	2.5	0.4
Fluoranthene	BMDL	-	112.5	0.4
Benzidene	-	-	-	10.0
Pyrene	BMDL	BMDL	118.0	0.5
Butylbenzyl phthalate	-	-	-	0.8
Chrysene	BMDL*	BMDL	24.0	0.4
Benzo(a)anthracene	BMDL*	BMDL	24.0	0.5
3,3-Dichlorobenzidene	-	-	-	2.0
Bis(2-ethylhexyl)phthalate	13.2	7.1	51.6	0.9
Di-n-octyl phthalate	-	-	BMDL	1.5
Benzo(a)pyrene	BMDL*	BMDL	BMDL	0.3
Benzo(k)fluoranthene	BMDL*	BMDL	BMDL	0.4
Benzo(b)fluoranthene	BMDL*	BMDL	BMDL	0.6
Dibenzo (a,h) anthracene	BMDL*	BMDL	BMDL	4.0
Benzo(g,h,i)perylene	BMDL*	BMDL	BMDL	2.0
Indeno(1,2,3-CD)pyrene	BMDL*	BMDL	BMDL	1.5
Coronene	-	-	-	2.5
Perylene	-	-	-	2.5

* = very low levels

	Upstream	Downstream	Collection Manhole	MDL (ppb)
ADDITIONAL COMPOUNDS				
4-Methyl Pyridine	-	-	-	0.8
Benzothiophene	-	-	-	0.4
Benzothiazole	-	-	-	0.8
Isoquinoline	-	-	-	0.5
1-Methyl Naphthalene	-	-	BMDL	0.5
1,2-Dimethyl Naphthalene	-	-	-	0.6
Dibenzofuran	-	-	6.3	0.3
2,3,5-Trimethyl Naphthalene	-	-	-	0.5
2-Methyl Anthracene	-	-	-	0.8

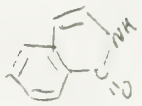
PESTICIDE COMPOUNDS	UPSTREAM	DOWNSTREAM	COLLECTION MANHOLE	MDL
Alpha BHC	Tr	-	-	10 ppt
Gamma BHC	-	-	-	"
Beta BHC	-	-	-	"
Delta BHC	-	-	-	"
Heptachlor	-	-	-	"
Aldrin	-	-	-	"
Heptachlor Epoxide	-	-	-	"
Alpha Endosulfan	-	-	-	"
4,4°-DDE	-	-	-	"
Dieldrin	-	-	-	"
Endrin	-	-	-	"
Beta Endosulfan	-	-	-	"
4,4°-DDD	-	-	-	"
Endrin Aldehyde	-	-	-	"
Endosulfan Sulfate	-	-	-	"
4,4°-DDT	-	-	-	"
Mirex	-	-	-	50 ppt
Total PCB	-	-	-	100 ppt
Toxaphene	-	-	-	200 ppt

Upper Ottawa Landfill Samples - Dec. 11, 1984

Additional Compounds Detected

- substituted benzoic acid ~~derivatives~~
  - dimethyl-
  - chloro, dichloro-

- methylated benzenes - C_1, C_4
- Benzothiazolone
- Isoquinalone
- Methoxy-1,2-Benzothiazole



Volatile Compounds

- low molecular weight aliphatic hydrocarbons
- methylated benzenes (C_1-C_4)
- tetrahydro thiaphene
- low M.W. ketones and alcohols - propanone
  - butanone
  - pentanone

The pesticide and PCB screen (Table III) duplicates in part the GC/MS screen but at a much lower detection limit. In general this improvement is from 10 to 100 times more sensitive. It is also very specific to halogenated compounds.

Because of its sensitivity and selectivity this screen compliments the GC/MS analysis. As seen in the previous monitoring programs there were no chlorinated pesticides detected above the MDL value of 10 ppt.

The majority of extractable organics detected were at the trace level. Bis(2-ethylhexyl) phthalate was determined between 7.1 and 51.6 ppb in all samples. The collection manhole sample showed an increased level of polynuclear aromatic compounds compared to previous monitoring programs. Additional compounds detected in the collection manhole sample are listed in Appendix A.

4.0 METHODOLOGY

Methods of analysis are equivalent to those given in Monitoring Report No. 1. A brief descriptionn of the methodology and quality control procedures have been included for your reference.

EXTRACTABLE ORGANICS

Procedure

1) A 1 litre volume of sample water was spiked at the 20 ppb level with a mixture of deuterated stds (the sample was shaken and allowed to equilibrate for 1 hr/RT).

2) The pH was adjusted to a pH 11 using 6 N NaOH and the sample extracted with 3 x 50 me volumes of CH_2Cl_2 (extracted out Base-Neutral and pesticide compounds).

3) The aqueous portion was then acidified to pH 2 using 6 N HCl and extracted with 3 x 50 ml volumes of CH_2Cl_2 to extract the acidic and phenolic compounds.

4) Similar organic extracts were combined and dried through a column of solvent washed Na_2SO_4 (acidified Na2S04 for the acid fraction).

5) The dried extracts were collected in 1 litre Kuderna-Danish evaporators containing 2 mls of isooctane then concentrated to a volume of approximately 2 ml (the acidic fraction was spiked with 20 ppb D_{10} Anthracene to replace that lost in the B/N extract).

6) The B/N fraction was transferred to a 10 ml graduated centrifuge tube (a 2 x 1 ml isooctane rinse) then concentrated to a 1 ml volume using a gentle stream of N_2 and spiked with 20 ppb D10 Phenanthrene.

7) To allow for the gas chromatographic analysis of the polar acidic compounds they were derivatized to their corresponding more volatile methyl ethers and esters using Diazomethane.

   - 1 ml of isooctane and 2.5 ml of 3% Diazomethane/ether solution was added to the concentrated acid extract, the mixture was shaken, sealed and allowed to stand at room temperature overnight. Excess diazomethane was removed and the volume concentrated to 1 ml using a stream of N_2, then spiked with 20 ppb D10 Phenanthrene.

Gas Chromatographic/Mass Spectrometry Instrumentation

One aliquots of the 1 ml extracts were analysed for the presence of the selected priority pollutants using a Finnigan 4500 GC/MS system set to the following conditions:

MASS SPECTROMETER

Electron Multiplier	-	1450 e.v.
Ionization Energy	-	70 e.v.
Sensitivity	-	108 amps/volt
Scan Rate	-	2.25 mSec/mass unit
Scan Range	-	1-2000
Mass Range	-	34-450 a.m.u.

FINNIGAN GAS CHROMATOGRAPH CONDITIONS

GC Column	-	DB-1 30 M capillary
GC Temp Program		
Initial	-	50oC (0.1 min)
Final	-	285oC (20 min)
Rate	-	-10oC/min
Injection Port Temp	-	250oC
Column Carrier Gas	-	Helium

4.0 ANALYTICAL METHODS

4.1 Volatiles

4.1.1 Sampling Preparation - Collection and Handling

Water samples for purgeable organics were collected in 250 ml capacity amber glass bottles equipped with Tuf-Bond discs and screw caps with a syringe access hole in the centre. The bottles had been previously cleaned and heated at 200oC for at least 4 hours, purged with nitrogen and sealed with PTFE coated silicone and open top caps prior to transportation to the sampling sites.

The bottles were filled to slight overflow, then sealed so that no air bubble was present in the sample. They were immediately returned to Mann Testing Labs and stored at 4oC until analysed.

4.1.2 Preparation of Standard Solutions

Stock standard solutions were prepared by injecting appropriate amounts of each pollutant into 25 ml of glass distilled methanol (Burdick and Jackson) in reactiflasks fitted with Minnert valves (Chromatographic Specialties Ltd.) which provide complete protection and easy access via a hypodermic needle. The resulting concentrations of 1 mg/ml were further diluted to give methanolic solutions of 400 ug/ml, 40 ugml and 4 ug/ml for each component. Gaseous standards were prepared in a similar manner by injecting the gaseous compound from a 10 ml gas tight syringe into a pre-weighed reactiflask filled with 25 ml of methanol. The syringe needle was slightly above the methanol meniscus while injecting,

hence enabling the gas to dissolve rapidly into the methanol. The flask was re-weighed again to determine the amount in the solution.

Aqueous composite standards were prepared by injecting appropriate aliquots of methanolic standard in 250 ml sample bottles filled with purified water.

The relative retention times (RRT) were compared to that of the internal standard, deuterated chlorobenzene (RRT = 1.00) which eluted close to the middle of the chromatogram. Detection limits were determined by purging aqueous composite standard mixture at various concentrations.

4.1.3 Instrumentation

Analysis of volatile organics in water was conducted using a UNACON 780B automatic concentrator (Envirochem Inc., Kemblesville, P.A.). This instrument utilized the technique developed by Bellar and Lichtenberg for the isolation and concentration of volatiles for chromatographic analysis. In general, this process involved gas stripping of the sample and adsorption of the organic compounds on a sorbent trap followed by thermal desorption and analysis by gas chromatography or gas chromatography/mass spectrometry.

The sample purging assembly included a sparger vial with a side port which was equipped with an open top screw cap and Tuf-Bond septum. A 30 ml vial was used to obtain detection limits as reported. Sample was transferred to the vial through a transfer line by pressurizing the sample bottle which was inverted and clamped on the side of the instrument. The transfer line was constructed of 1/16" teflon tubing with two Luer Lock connectors at

each end. Two 17-gauge needles were used to puncture the septa of both the bottle and the side port.

Prior to the start of the analysis, the sparger vial was purged with helium for 5 minutes by rotating the valve to "Trap-Out" mode. In this position, any contaminants that were present in the sparger vial were purged out of the system without entering the trap. An appropriate aliquot of the water was then transferred to the sparger and purged for 15 minutes at the "Trap-In" mode. The trap was heat desorbed and the organics backflushed into the second trap. When this transfer process was completed, the second trap was again heated, releasing all adsorbed organics into the capillary GC/MS system for identification and quantification.

The water sample was analysed 3 times using 1 ml, 10 ml and 30 m volumes to eliminate saturation of the GC/MS system.

The MDL (Method Detection Limit) listed in the volatile section is the limit that the compound can be identified and quantified in the sample matrix using the purge & trap GC/MS method.

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Sampling Date: October 19, 1984

Report Date: January 17, 1985

Reference No: Lab. No. 842007

MONITORING OF LEACHATE & REDHILL CREEK

UPPER OTTAWA STREET LANDFILL SITE

REPORT NO. 3

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APPENDIX A - Dioxin Analysis Methodology

LIST OF TABLES

TABLE I - Concentrations of Volatile Organics in Wastewater Samples (ppb)

TABLE II - Upper Ottawa Priority Pollutants GC/MS Acid Extractables Acidic Compounds

- Upper Ottawa Priority Pollutants GC/MS Base/Neutral Extractables Base/Neutral Compounds

- Upper Ottawa Priority Pollutants GC/MS Additional Compounds

TABLE III - Upper Ottawa Priority Pollutants Pesticide Scan by ECD

1.0 INTRODUCTION

This report is the third of a water monitoring program for the Upper Ottawa Street Landfill. Previous reports were submitted on September 22, 1983 and October 18, 1984 under Mann Testing reference no.s 830320 and 841279 respectively.

Please refer to those reports for background information.

In addition a water sample from the leachate collection manhole site was screened for the presence of 2,3,7,8-tetrachlorodibenzodioxin (2,3,4,5-TCDD). Results are presented in Appendix C.

2.0 SAMPLING

Three water samples were secured by J. Martin of Mann Testing Laboratories Ltd. Sampling sites and methods were identical to those for the first and second monitoring program.

3.0 RESULTS OF TARGET ANALYSIS

3.1 General

The three samples were analysed by GC/MS spectrometry based on EPA Priority Pollutant analysis methodology. In addition an extremely sensitive dual column, dual ECD detector gas chromatographic system was used for chlorinated organics. In total twenty of the most common chlorinated hydrocarbons (pesticides and PCB°s) were screened in the part per trillion range.

The levels and types of organic contaminants found during this monitoring program were comparable to the previous monitoring programs. For immediate comparison purposes the following are listed from the Leachate Collection Manhole:

	Amount (ppb)		
Compound	1st Monitoring	2nd Monitoring	3rd Monitoring
Tetrahydrofuran	1212	1548	2456
Chloroform	22	2	-
1,4-Dichlorobenzene	9	6	1.0
1,4-Dioxane	18663	949	6745
Phenol	98	TR	TR
Napthalene	11.8	TR	TR

This is not a total list of all contaminants found but does give an idea of the general trend.

3.2 Dioxin Analysis

A water sample from the leachate collection manhole site was screened for the presence of 2,3,7,8-tetrachlorodibenzodioxin. The results are as follows:

2,3,7,8-TCDD	Conc.	MDL
Leachate collection manhole	Not Detected	5.0 ppt

Details of the extraction method and sample chromatograms from the 2,3,7,8-TCDD analysis are included in Appendix A for your reference.

3.3 Volatile Organics - Results

Table No. I is a presentation of volatile organics targetted for quantitation purposes.

The Collection Manhole sample showed higher concentrations of tetrahydrofuran and 1,4-dioxane than seen in the second monitoring program.

The Red Hill Creek samples showed the same relative trend. None of the target compounds were present above the minimum detection limit as was seen in the previous studies.

3.4 Extractable Organics - Results

The results of analysis by GC/MS have been summarized in Table II. Further analysis by a dual column capillary gas chromatograph with dual electron capture detectors is given in Table III.

The pesticide and PCB screen (Table III) duplicates in part the GC/MS screen but at a much lower detection limit. In general this improvement is from 10 to 100 times more sensitive. It is also very specific to halogenated compounds.

Because of its sensitivity and selectivity this screen compliments the GC/MS analysis. As seen in the previous monitoring programs there were no chlorinated pesticides detected above the MDL value of 10 ppt.

The majority of extractable organics detected were at the trace level. Bis(2-ethylhexyl) phthalate was determined between 6.0 and 17.6 ppb in all samples. It was the highest level of the targetted contaminants. The collection manhole sample showed a high level of aliphatic hydrocarbons along with high levels (estimated at 5-20 ppb) of methylated phenols (dimethy to tetramethyl).

4.0 METHODOLOGY

Methods of analysis are equivalent to those given in Monitoring Report No. 1. All quality control procedures, recoveries and mass chromatograms are available on request.

Concentrations of Volatile Organics in Upper Ottawa St. Landfill Samples (ppb)

Compound	Redhill Creek Upstream	Redhill Creek Downstream	Leachate Collection Manhole	MDL
GEABLES				
Dichlorodifluromethane	-	-	-	1
Trichlorofluoromethane	-	-	-	1
Vinyl chloride	-	-	-	3
Chloromethane	-	-	-	1
Chloroethane	-	-	-	3
Bromomethane	-	-	-	1
1,1 Dichloroethylene	-	-	-	1
Acrolein	-	-	-	10
t-1,2 Dichloroethylene	-	-	-	1
1,1 Dichloroethane	-	-	-	1
Carbon tetrachloride	-	-	-	1
1,1,1 Trichloroethane	-	-	-	1
Dichloromethane	TR	-	21.8 ppm	5
Benzene	-	-	TR	1
Trichloroethylene	-	TR	-	1
Acrylonitrile	-	-	-	10
Chioroform	-	-	-	1
Tetrachloroethylene	-	-	-	1
1,2 Dichloropropane	-	-	-	1
Toluene	-	-	2.6	1
1,2 Dichloroethane	-	-	-	1
2 Chloroethyl Vinyl ether	-	-	-	ND
Ethyl Benzene	-	-	-	1
1,3 Dichloropropene (Z)	-	-	-	1
p-Xylene)				
m-Xylene)	-	-	7.8	1
Bromodichloromethane	-	-	-	1
O-Xylene	TR	-	5.7	1
1,3 Dichloropropene (E)	-	-	-	1
Chlorobenzene	-	-	-	1
1,1,2-Trichloroethane	-	-	-	1
Dibromochloromethane	-	-	-	1
1,3 Dichlorobenzene	-	-	-	1
Hexachloroethane	-	-	-	1
Bromoform	-	-	-	1
1,4 Dichlorobenzene	-	-	1.0	1
1,1,2,2-Tetrachloroethane	-	-	-	1
1,2 Dichlorobenzene	-	-	-	1
a-chlorotoluene	-	-	-	1
Bis-(chloromethyl)ether	-	-	-	ND
Bis-(2-chloroethoxy)methane	-	-	-	ND
Acetone	4.80	-	-	2
Diethyl ether	-	-	-	2
Carbon disulphide	-	-	-	1
Ethyl methyl Ketone	-	-	-	1
Tetrahydrofuran	-	4.5	2456.6	1
1,4-Dioxane	-	68.4	6744.9	80
N-Methyl-N-Nitrosomethanamine	-	-	-	ND
Styrene	-	-	-	1
1,2,3,4-Tetramethyl benzene	-	-	-	1
Aniline	-	-	-	ND
4-Methyl Pyridine	-	-	-	ND
1-Methyl-2 Pyrrolidine	-	-	-	ND

Trace Amount Detected Below MDL

her Compounds Detected

4 Isomers
C_3-Benzene

11 Isomers
C_4-Benzene

Dihydro-1H-
Indene

Dihydro-
Methyl-1H-
Indene

Hydrocarbon

Trimethyl

Cyclohexanone

Methyl Propanal

Methyl-Butanone

Methyl Thiethane

4-Penten-2-one

O-(2-Methyl
propyl)-
Hydroxylamine

Trimethyl
Hexene

Dimethyl
Pentanone

4 Isomers
C_3-Benzene

5 Isomers
C_4-Benzene

UPPER OTTAWA PRIORITY POLLUTANTS

October 19, 1984

(Conc. = ppb, ug/l)

ACIDIC COMPOUNDS	Upstream	Downstream	Collection Manhole	MDL (ppb)
Phenol	-	-	Tr	1.5
2-Chlorophenol	-	-	-	2.0
2,4-Dimethyl phenol	-	Tr	Tr	2.0
p-Chloro-m-cresol	-	-	-	2.0
2,4-Dichlorophenol	-	-	-	2.5
2,4,6-Trichlorophenol	-	-	-	3.0
2-Nitrophenol	-	-	-	2.0
2,4-Dinitrophenol	-	-	-	5.0
4,6-Dinitro-o-cresol	-	-	-	4.0
Pentachlorophenol	-	-	-	3.0
4-Nitrophenol	-	-	-	2.1
2,4-D	-	-	-	2.5
Silvex	-	-	-	2.4
o-Cresol	-	-	-	2.1
m-Cresol	-	-	-	2.3
p-Cresol	-	-	-	3.0
2,4,5-Trichlorophenol	-	-	-	2.0
2,4,5-T	-	-	-	2.5

Tr = Trace amount is detected below MDL

UPPER OTTAWA PRIORITY POLLUTANTS

October 19, 1984

BASE/NEUTRAL COMPOUNDS	Upstream	Downstream	Collection Manhole	M.D. (ppb)
Bis(2-Chloro Ethyl)Ether	-	-	-	1.0
1,4-Dichlorobenzene	Tr	Tr	3.9	0.4
1,3-Dichlorobenzene	-	-	-	0.4
bis(2-Chloroisopropyl)ether	-	-	-	1.0
1,2-Dichlorobenzene	-	-	Tr	0.4
Nitrobenzene	-	-	-	0.5
N-Nitrosodi-n-propylamine	-	-	-	0.5
Hexachloroethane	-	-	-	1.0
Isophorone	-	-	-	0.4
bis(2-Chloroethoxy)methane	-	-	-	0.4
Naphthalene	2.9	Tr	Tr	0.4
1,2,4-Trichlorobenzene	-	-	-	1.3
Hexachlorobutadiene	-	-	-	0.5
Hexachlorocyclopentadiene	-	-	-	3.0
2-Chloronaphthalene	-	-	-	0.8
2,6-Dinitrotoluene	-	-	-	2.0
Dimethyl phthalate	-	-	-	1.0
Acenaphthylene	-	-	Tr	0.5
Acenaphthene	1.7	0.7	1.3	0.4
2,4-Dinitrotoluene	-	-	-	1.5
Diethyl phthalate	-	-	-	5.0
9H Fluorene	1.4	1.8	-	0.4
4-Chlorophenyl phenyl ether	-	-	-	1.0

BASE/NEUTRAL COMPOUNDS	Upstream	Downstream	Collection Manhole	MDL (ppt)
N-Nitroso-Diphenylamine	-	-	-	..
1,2-Diphenyl Hydrazine	-	-	-	0.6
4-Bromophenyl phenyl ether	-	-	-	0.5
Hexachlorobenzene	-	-	-	1.2
Phenanthrene	1.2	-	2.5	0.3
Anthracene	-	-	Tr	0.3
Di-n-butyl phthalate	Tr	-	-	0.4
Fluoranthene	Tr	Tr	Tr	0.4
Benzidene	-	-	-	10.0
Pyrene	Tr	Tr	Tr	0.5
Butylbenzyl phthalate	-	-	-	0.8
Chrysene	Tr	-	Tr	0.4
Benzo(a)anthracene	Tr	-	Tr	0.5
3,3-Dichlorobenzidene	-	-	-	2.0
Bis(2-ethylhexyl)phthalate	6.0	7.2	17.6	0.9
Di-n-octyl phthalate	-	-	-	1.5
Benzo(a)pyrene	Tr	-	-	0.3
Benzo(k)fluoranthene	-	-	-	0.4
Benzo(b)fluoranthene	-	-	-	0.6
Dibenzo (a,h) anthracene	-	-	-	4.0
Benzo(g,h,i)perylene	-	-	-	2.0
Indeno(1,2,3-CD)pyrene	-	-	-	1.3
Coronene	-	-	-	2.5
Perylene	-	-	-	2.5

	Upstream	Downstream	Collection Manhole	MDL (ppb)
ADDITIONAL COMPOUNDS				
4-Methyl Pyridine	-	-	-	0.4
Benzothiophene	-	-	Tr	0.4
Benzothiazole	-	-	-	0.8
Isoquinoline	Tr	-	-	0.5
1-Methyl Naphthalene	Tr	-	Tr	0.5
1,2-Dimethyl Naphthalene	-	-	Tr	0.6
Dibenzofuran	Tr	-	-	0.3
2,3,5-Trimethyl Naphthalene	-	-	-	0.5
2-Methyl Anthracene	-	-	Tr	0.8

PESTICIDE COMPOUNDS	UPSTREAM	DOWNSTREAM	COLLECTION MANHOLE	MDL
Alpha BHC	Tr	-	-	10 ppt
Gamma BHC	-	-	-	"
Beta BHC	-	-	-	"
Delta BHC	-	-	-	"
Heptachlor	-	-	-	"
Aldrin	-	-	-	"
Heptachlor Epoxide	-	-	-	"
Alpha Endosulfan	-	-	-	"
4,4°-DDE	-	-	-	"
Dieldrin	-	-	-	"
Endrin	-	-	-	"
Beta Endosulfan	-	-	-	"
4,4°-DDD	-	-	-	"
Endrin Aldehyde	-	-	-	"
Endosulfan Sulfate	-	-	-	"
4,4°-DDT	-	-	-	"
Mirex	-	-	-	50 ppt
Total PCB	-	-	-	100 ppt
Toxaphene	-	-	-	200 ppt

UPPER OTTAWA MANHOLE SITE

Additional Compounds observed - Extractable fraction

- high aliphatic hydrocarbon background
- methylated benzenes (C3 - C4)
- dimethyl phenols (5 - 20 ppb)
- trimethyl phenol
- tetramethyl phenol (5 - 20 ppb)

Appendix C

DIOXIN ANALYSIS - WATER SAMPLE

Extraction

A 1 liter volume of sample is spiked with 10 ng of ^{13}C-2,3,7,8-TCDD as an internal standard (level = 10 ppt).

The sample is extracted at neutral pH with 3 x 75 ml of CH_2Cl_2. The combined extracts are dried through a Na_2SO_4 column. 5 ml of toluene is added as a keeper, and the extract concentrated to approximately 1 ml.

The extract is then subjected to a multi-adsorbent column chromatographic clean-up (Dow Chemical method), and the extract concentrated to 100 ul.

GC/MS Analysis

Analysis is conducted by GC/MS operating under the Electron Impact/Multiple Ion detection mode.

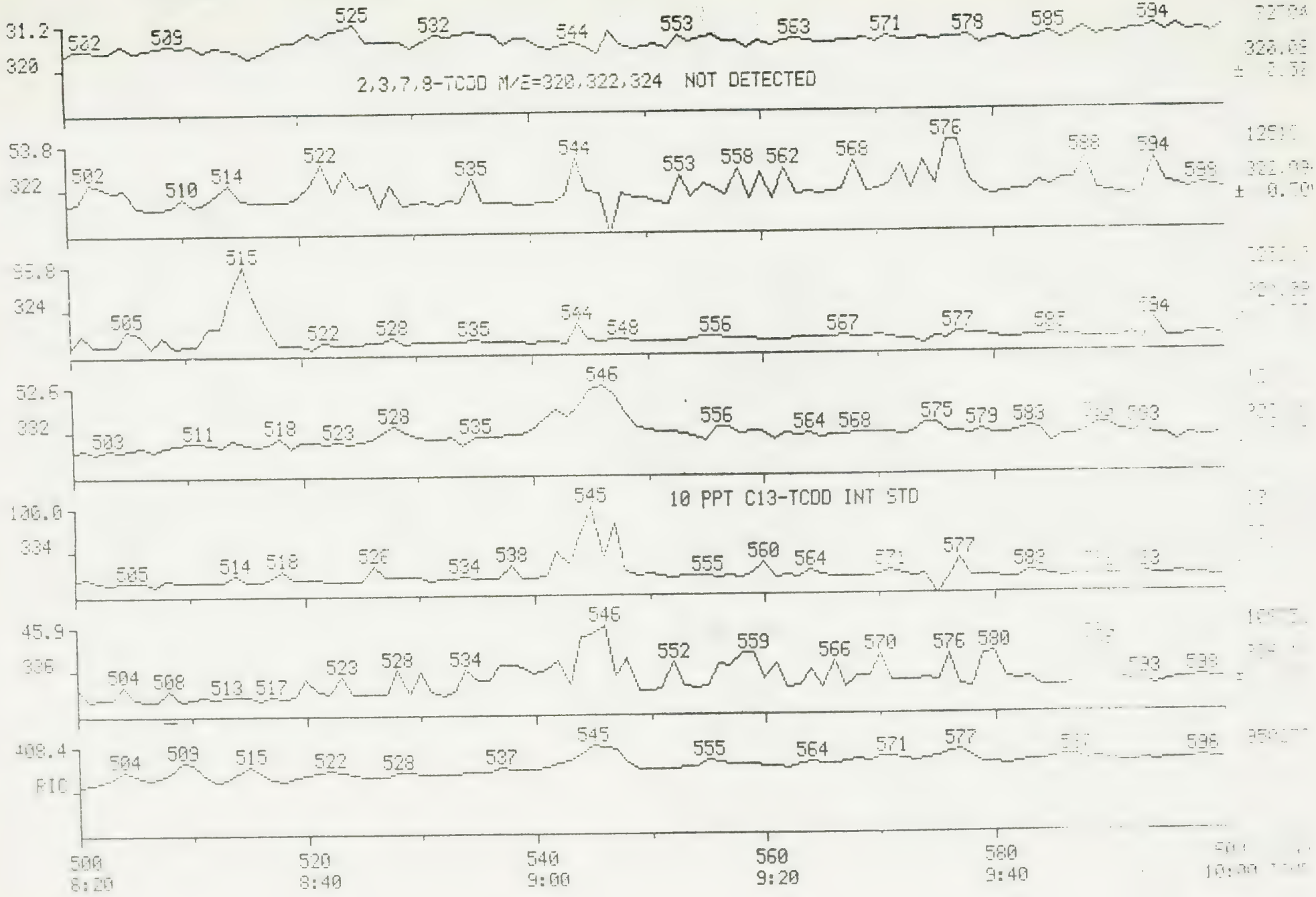
GC/MS Finnigan 4000/45000

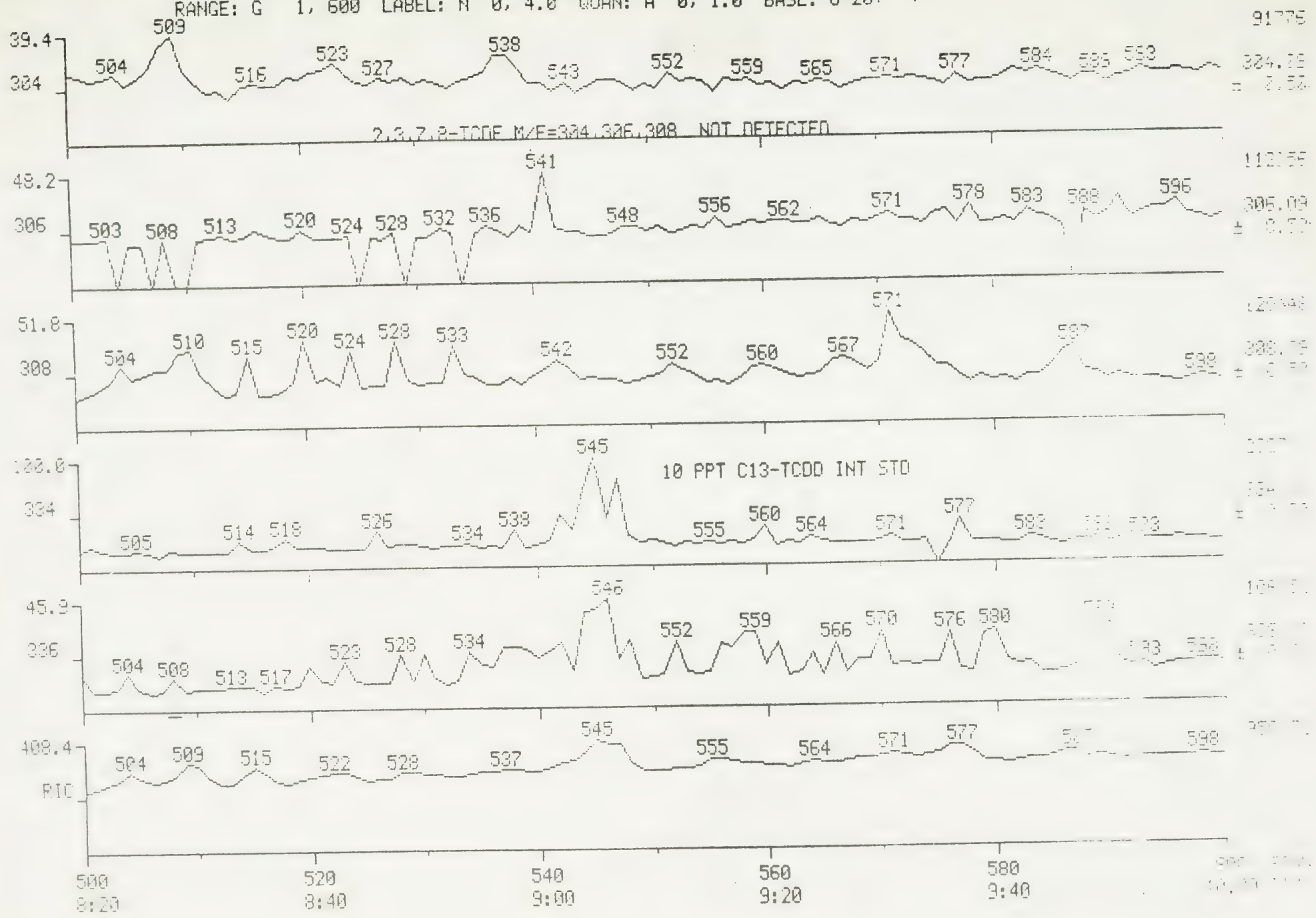
eM = 1750 eV
eV = 28 eV
Column = DB-5 30 M, 0.25 mm I.D.
Program = 130°C, 1 minute to 285°C by 10°C/minute

RIC + MASS CHROMATOGRAMS
01/05/85 14:40:00
SAMPLE: UPPER OTTAWA COLLECTION MANHOLE SITE 2,3,7,8-TCDD SCREEN
RANGE: G 1, 500 LABEL: N 0, 4.0 QUAN: A 0, 1.0 BASE: U 20, 3

DATA: EFP0039 #1
CALI: 8482 #1

SCANS 500 TO 600

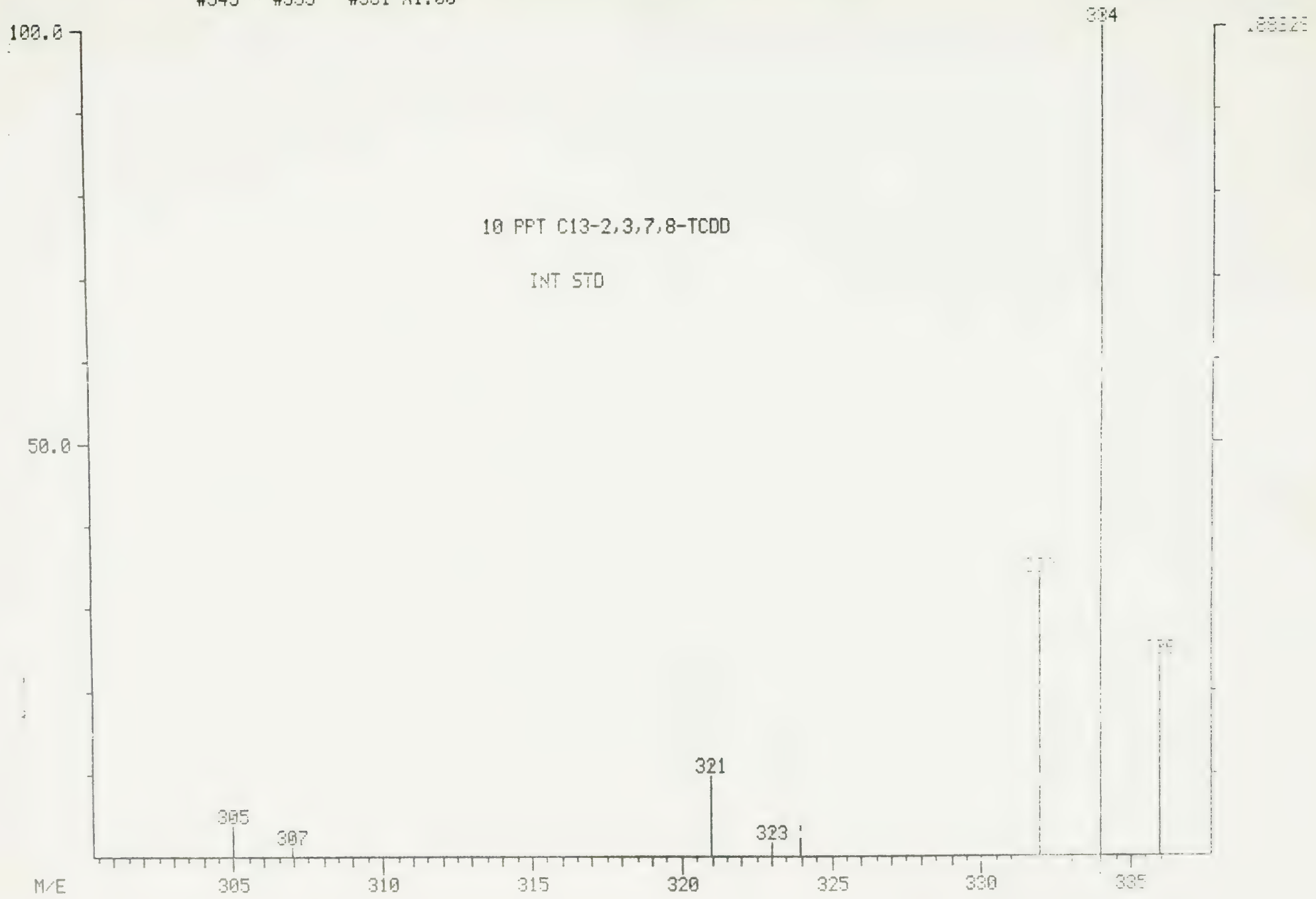



RIC + MASS CHROMATOGRAMS
01/05/85 14:40:00
SAMPLE: UPPER OTTAWA COLLECTION MANHOLE SITE 2,3,7,8-TCDD SCREEN
RANGE: G 1, 600 LABEL: N 0, 4.0 QUAN: A 0, 1.0 BASE: U 20.
DATA: EFP0039 #1
CALI: 8482 #1
SCANS 500 TO 600
2,3,7,8-TCDF M/E=304.306.308 NOT DETECTED
10 PPT C13-TCDD INT STD
RIC
500
8:20
520
8:40
540
9:00
560
9:20
580
9:40

MASS SPECTRUM
01/05/85 14:40:00 + 9:05
SAMPLE: UPPER OTTAWA COLLECTION MANHOLE SITE 2,3,7,8-TCDD SCREEN
#545 - #535 - #561 X1.00

DATA: EFP0039 #545
CALI: 8482 #1

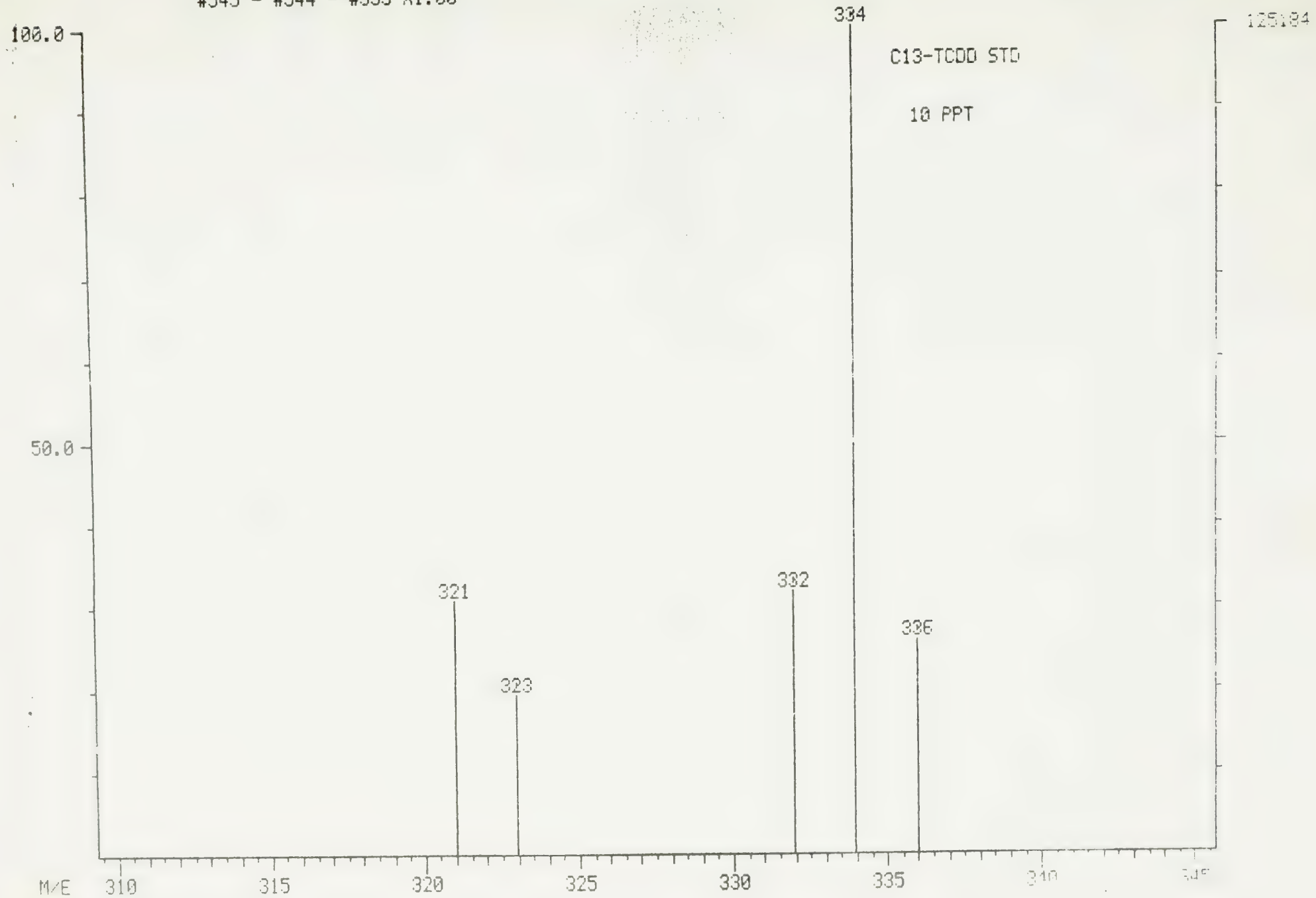
BASE M/E: 334
RIC: 332800.



MID MASS SPECTRUM
01/05/85 14:40:00 + 9:05
SAMPLE: UPPER OTTAWA COLLECTION MANHOLE SITE 2,3,7,8-TCDD SCREEN
#545 - #544 - #553 X1.00

DATA: EFP0039 #545
CALI: 8482 #1

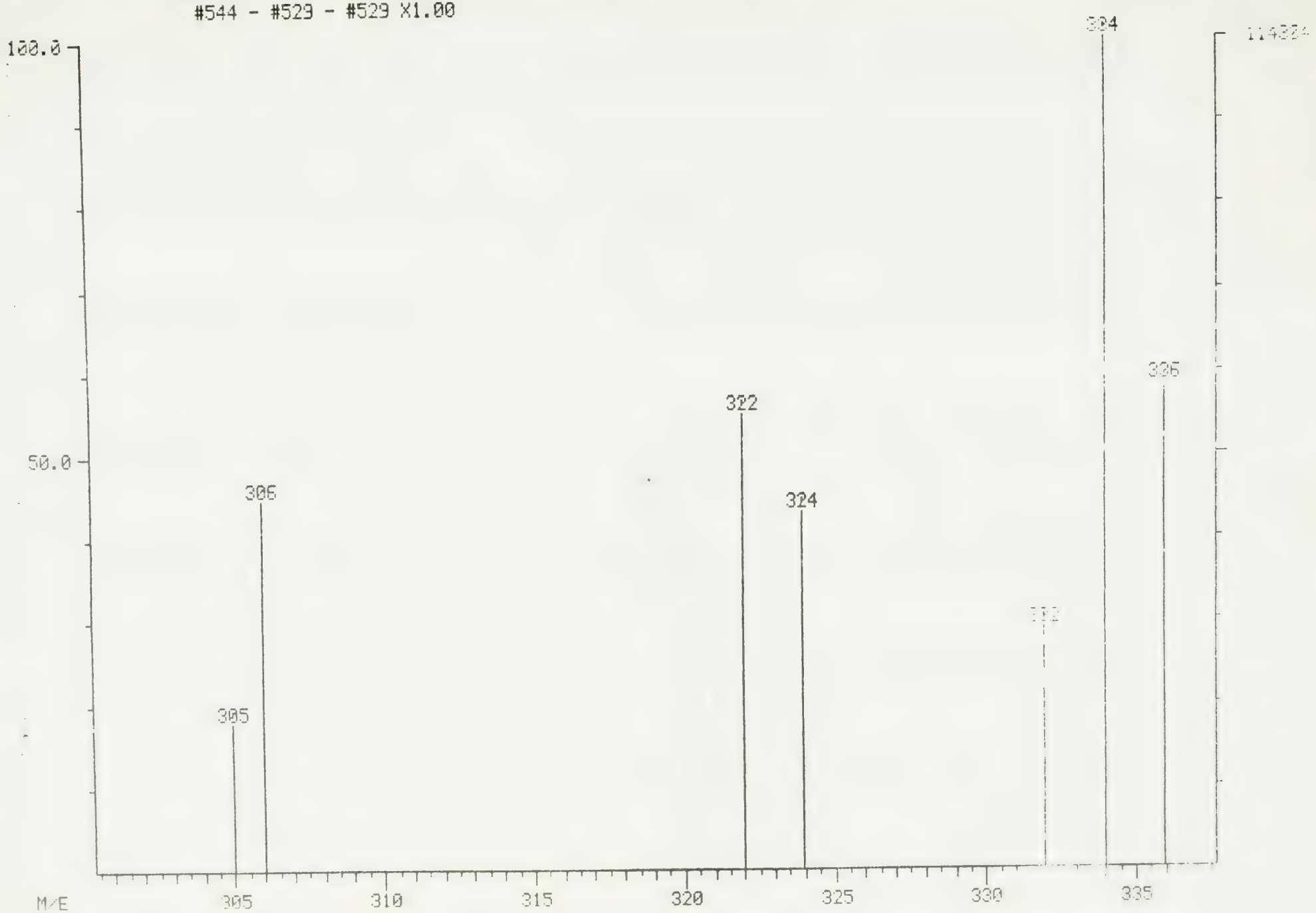
BASE M/E: 334
RIC: 261888.



MASS SPECTRUM
01/05/85 14:40:00 + 9:04
SAMPLE: UPPER OTTAWA COLLECTION MANHOLE SITE 2,3,7,8-TCDD SCREEN
#544 - #529 - #529 X1.00

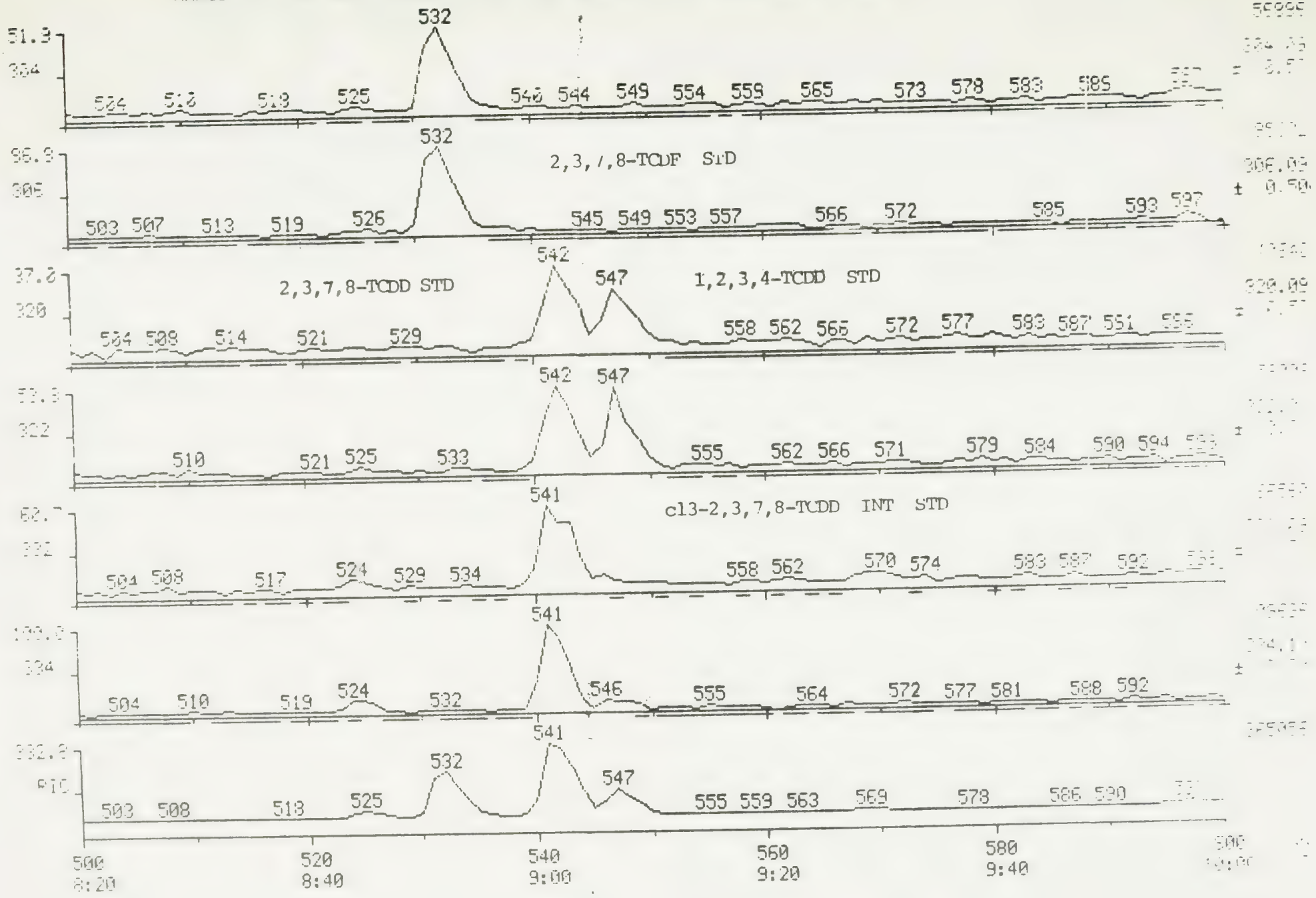
DATA: EFP0039 #544
CALI: 8482 #1

BASE M/E: 334
RIC: 397824.



MID RIC + MASS CHROMATOGRAMS
01/05/85 13:55:00
SAMPLE: DIOXIN STD ON COL MID 51,52 50PG/ULX2UL
RANGE: G 1, 620 LABEL: N 0, 4.0 QUAN: A 0, 1.0 BASE: U 20, 3

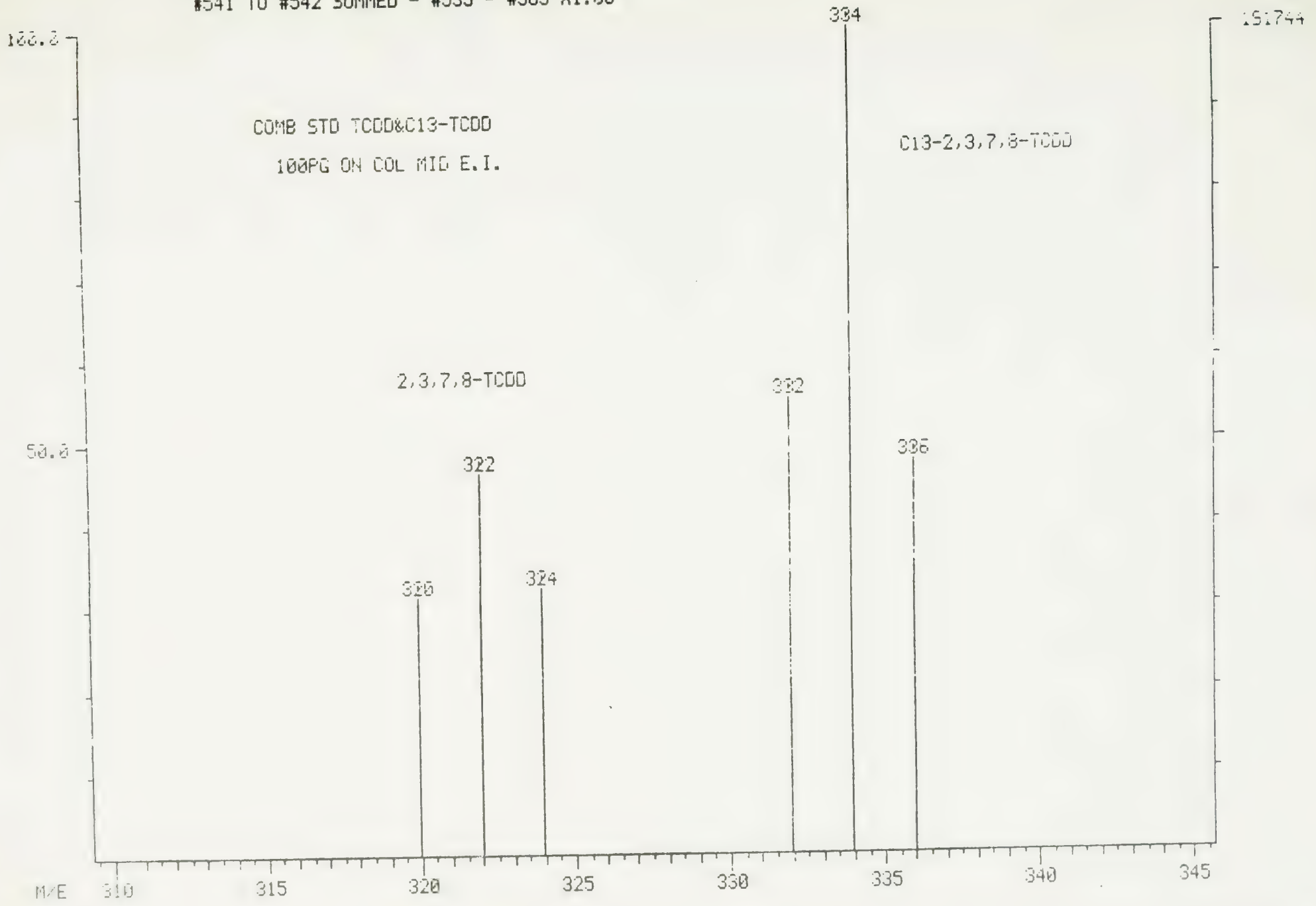
DATA: EF6038 #1
CALI: 8482 #1

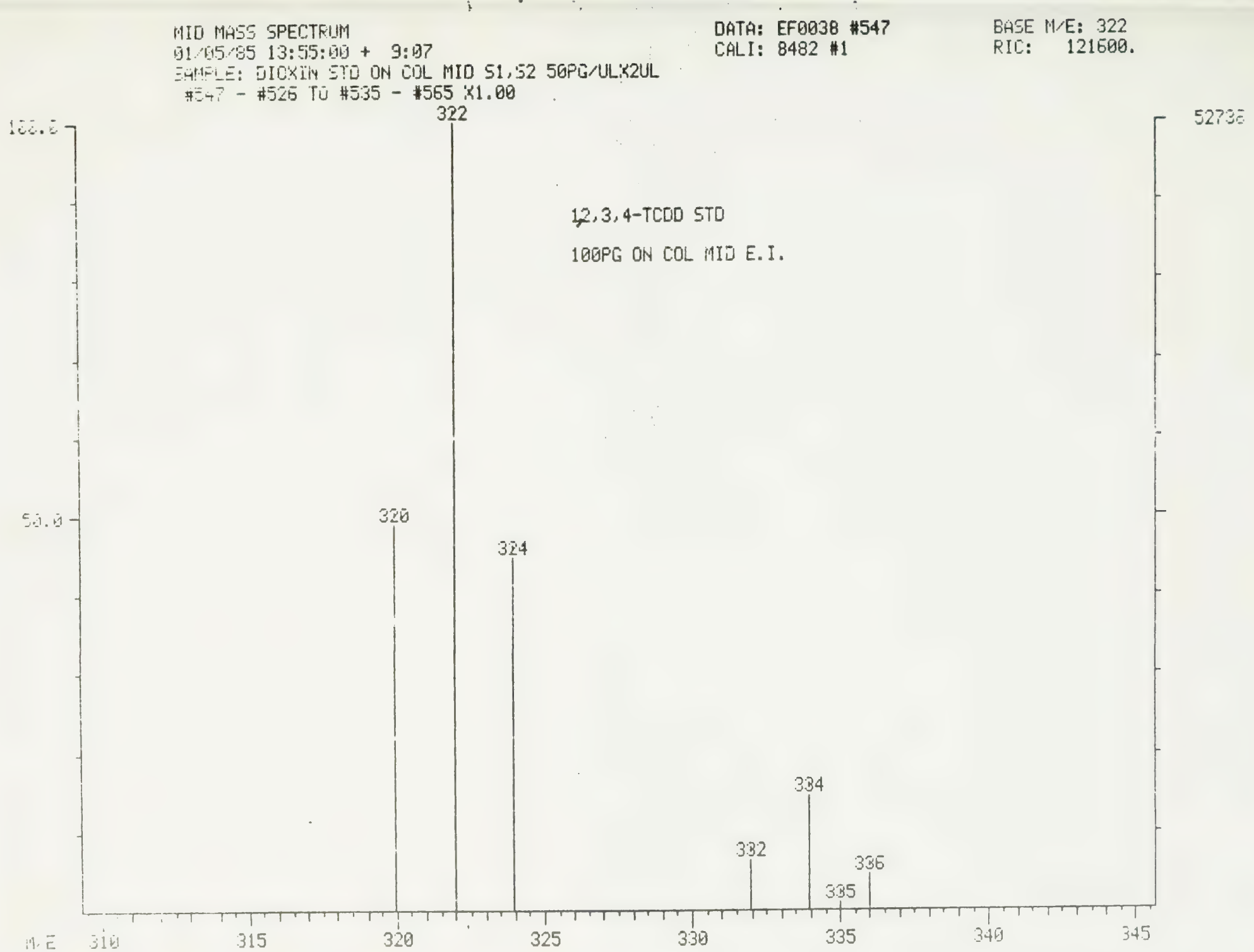


MID MASS SPECTRUM
01/05/85 13:55:00 + 9:01
SAMPLE: DIOXIN STD ON COL MID S1,S2 50PG/ULX2UL
#541 TO #542 SUMMED - #535 - #565 X1.00

DATA: EF0038 #541
CALI: 8482 #1

BASE M/E: 334
RIC: 608256.

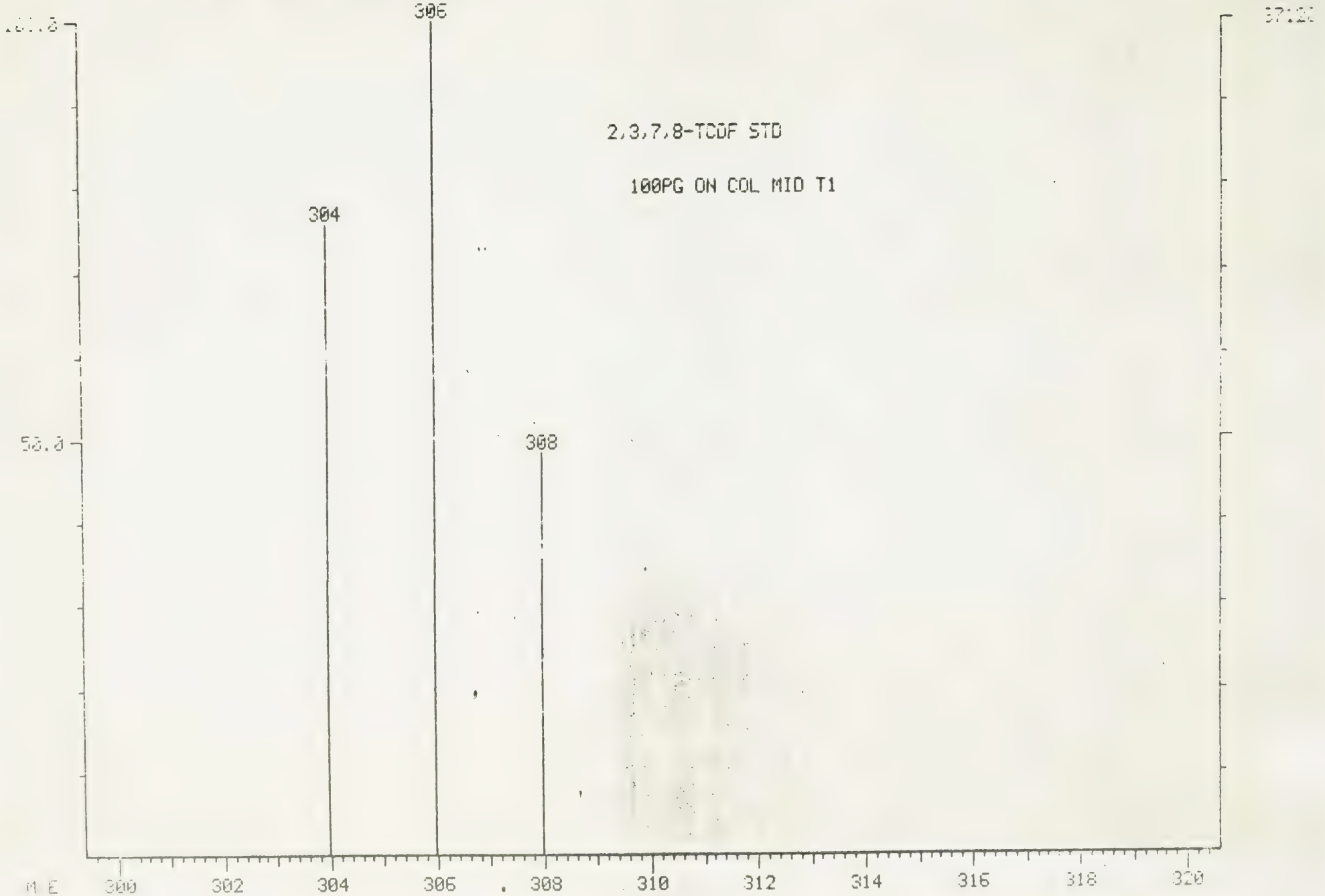



MID MASS SPECTRUM
01/05/85 13:55:00 + 9:07
SAMPLE: DIOXIN STD ON COL MID S1,S2 50PG/UL,K2UL
#547 - #526 TO #535 - #565 X1.00
DATA: EF0038 #547
CALI: 8482 #1
BASE M/E: 322
RIC: 121600.
100.0
50.0
M/E
310
315
320
325
330
335
340
345
322
320
324
332
334
335
336
1,2,3,4-TCDD STD
100PG ON COL MID E.I.

MID MASS SPECTRUM
01/07/85 9:43:00 + 8:53
SAMPLE: DIOXIN STD STM20 50PG/ULX2UL MID T.I
#533 - #527 - #543 X1.00

DATA: EF0042 #533
CALI: 8482 #1

BASE M/E: 306
RIC: 83200.



2,3,7,8-TCDF STD

100PG ON COL MID T1

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